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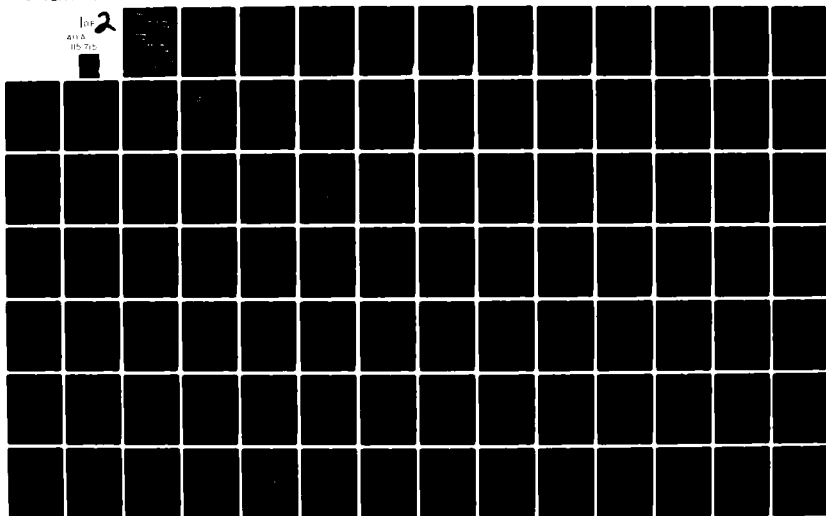
CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT
DEEPENING AND EXTENDING CHANNELS FOR NAVIGATION. CHARLESTON HAR--ETC(U)
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PHASE 1

Final Report

CHARLESTON HARBOR

SOUTH CAROLINA

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DEEPENING

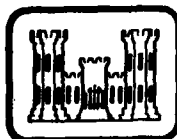
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FOR NAVIGATION

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report recommends deepening the existing Charleston and Shipyard River Project, to 40 and 38 feet respectively. Some additional basin and channel widening is also recommended. Ocean disposal was the most viable means of disposing of the dredged material.													

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Syllabus

The purpose of this navigation study was to determine if the recommendations presented in the Interim Review of Reports on Charleston Harbor were still justified under the WRC Principles and Standards.

Various solutions to the problems and needs of continued harbor development were analyzed. Based on the results of this analysis and demonstrated interest by private industry and local authorities, it is concluded that the most feasible plan for satisfying future harbor needs consists of deepening the existing Charleston Harbor and Shipyard River channels. Minor channel widening and improving the anchorage and turning basins to commensurate depths with the channels will be provided. Therefore, it is recommended that the existing projects for Charleston Harbor and Shipyard River, South Carolina, be modified to provide for the construction and maintenance of a 40-foot and 38-foot Federal navigation project in Charleston Harbor (Cooper River) and Shipyard River.

Construction would be by the United States after congressional authorization and funding and after receipt of the non-Federal share of the cost. The total Federal first cost for the recommended plan of improvement would be \$47,541,000 and the total non-Federal first cost would be \$9,637,000. The estimated average annual benefits and benefit-cost ratio are \$16,784,000 and 2.11 to 1.0, respectively.

Following construction, the Federal Government would maintain project depths in the improved channel. Non-Federal interests would maintain all levees and spillways of project disposal areas and commensurate depth at dock facilities. Studies show that ocean disposal is the most economical means of disposing of dredged material from the proposed modifications to Charleston Harbor. There is a possibility that the special equipment required to transport the dredged material to sea may not be available in time for initial construction of the project; therefore, the use of upland areas on Daniel Island is being used to

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estimate costs and environmental impacts. Disposal of dredged material during construction operations would be as follows:

(1) Continued use of Morris Island and the offshore disposal area for the anchorage and entrance channel and outer bar, respectively; and,

(2) Inland disposal areas located on and northward of Daniel Island and above the existing marshes for the upper harbor reaches.

Dredging in the entrance channel and outer bar would be by either Government-owned or contractor hopper dredge with the remaining work being accomplished by contract pipeline dredge.

CHARLESTON HARBOR
PHASE I AE&D STUDIES

Table of Contents

<u>Item</u>	<u>Page</u>
INTRODUCTION	1
Study Authority	1
Scope of Study	1
Study Participants and Coordination	2
Prior Studies and Reports	2
Studies by Others	3
The Report and Study Process	3
PROBLEM IDENTIFICATION	5
National Objective	5
Existing Condition	6
Condition If No Federal Action Is Taken	8
Problems, Needs and Opportunities	9
Planning Constraints	16
Planning Objectives	17
FORMULATION OF PRELIMINARY PLANS	18
Alternatives	18
Channel Modification	18
ASSESSMENT AND EVALUATION OF DETAILED PLANS	20
Plan 3	21
Plan Description	21
Disposal of Material	24
Impact Assessment	24
Implementation Responsibilities	25
Cost Allocation	25
Federal Responsibilities	27
Non-Federal Responsibilities	27

Table of Contents (Cont'd)

<u>Item</u>	<u>Page</u>
Plan 4	28
Plan Description	28
Disposal of Material	28
Impact Assessment	28
Implementation Responsibilities	28
Cost Allocation	28
Federal Responsibilities	30
Non-Federal Responsibilities	30
Plan 7	31
Plan Description	31
Disposal of Material	32
Impact Assessment	32
Implementation Responsibilities	32
Cost Allocation	32
Federal Responsibilities	34
Non-Federal Responsibilities	34
Plan 8	34
Plan Description	34
Disposal of Material	34
Impact Assessment	34
Implementation Responsibilities	35
Cost Allocation	35
Federal Responsibilities	35
Non-Federal Responsibilities	35
Public Views	35
COMPARISON OF DETAILED PLANS	35
Plan Comparison	37
Rationale for Designation of NED Plan	39
Rationale for Designation of EQ Plan	39
Rationale for Designation of Selected Plan	46

Table of Contents (Cont'd)

<u>Item</u>	<u>Page</u>
CONCLUSIONS	46
RECOMMENDED PLAN	52
ENVIRONMENTAL ASSESSMENT	54
RECOMMENDATIONS	118

List of Tables

<u>No.</u>	<u>Title</u>	<u>Page</u>
1	Summary of Annual Charges and Benefits	19
2	Plan 3 - Summary First Cost and Annual Charges (Cooper River - Upland Disposal)	26
3	Plan 4 - Summary First Cost and Annual Charges (Cooper River - Ocean Disposal)	29
4	Plan 7 - Summary First Cost and Annual Charges (Shipyard River - Upland Disposal)	33
5	Plan 8 - Summary First Cost and Annual Charges (Shipyard River - Ocean Disposal)	36
6	Comparison of Plans	38
7	System of Accounts - Charleston Harbor	40-42
8	System of Accounts - Shipyard River	43-45
9	Summary System of Accounts - Charleston Harbor	48-49
10	Summary System of Accounts - Shipyard River	50-51

CHARLESTON HARBOR

PHASE 1 A E & D STUDIES

Introduction

The great importance of the Port of Charleston to the economic and social well-being of the citizens of South Carolina has long been recognized. If the port is to continue as a viable and safe harbor, adequate terminal facilities and navigation channels must be provided. Otherwise the port will stagnate economically and become ineffective in accommodating the needs of its many dependents, thereby adversely affecting the maritime contribution to the state's economy.

STUDY AUTHORITY

This study was authorized by the 94th Congress in Section 101 of the Water Resources Act of 1976. The interim review of reports on Charleston Harbor is contained in House Document 94-436, 94th Congress, 2nd Session. It was referred to the Committee on Public Works and Transportation and ordered to be printed with illustrations on April 2, 1976.

SCOPE OF STUDY

Engineering, economic/commerce, and environmental studies were made in the depth and detail needed to permit plan selection and to determine its feasibility. Economic studies included investigations to determine the present and prospective commerce to be moved over the waterway. Engineering studies included investigations to determine the present and future size of vessels, channel dimensions required

to accommodate vessels transiting the waterway, and estimates of the cost of constructing and maintaining contemplated modifications. Environmental studies were conducted to evaluate the effects of contemplated modifications on water quality, wetlands, recreation, fish and wildlife, and cultural resources. Studies included chemical analysis of bottom sediments, effects of water quality changes from dredging and disposal of material on planktonic species and larval estuarine fish, and evaluation and inventory of marshlands.

STUDY PARTICIPANTS AND COORDINATION

Charleston District was assigned the responsibility for the conduct and coordination of this study, consolidation of information from other agencies and local interests, formulation of a plan and preparation of this report. A multi-disciplinary team was used to accomplish these tasks. The team was composed of a project engineer, biologist, economist, cost estimator, and a foundations and material specialist. Additional assistance was provided by real estate appraisers, surveyors, and others as specific data and analysis were required.

All known interested Federal, state, and local agencies and individuals were notified of the initiation of this study. Numerous conferences were held with representatives of the South Carolina State Ports Authority and private industry. The District Engineer coordinated the study with the U. S. Fish and Wildlife Service and the Environmental Protection Agency as well as with appropriate state and local agencies. A public meeting was held 5 February 1980.

PRIOR STUDIES AND REPORTS

Information regarding prior reports that authorized the existing Federal navigation projects for Charleston Harbor and Shipyard River, South Carolina, are listed in Section A of Appendix 1 of the interim review of reports on Charleston Harbor, dated 9 October 1974.

R 5-22-80

STUDIES BY OTHERS

As part of the evaluation of alternatives, bioassays, benthic and sedimentologic studies were conducted under contract to demonstrate the acceptability of material from Charleston Harbor for ocean disposal. Summaries of these studies are included in the Supplemental Information Report.

THE REPORT AND STUDY PROCESS

The interim review of reports on Charleston Harbor (HD 94-436) was submitted to Congress on 29 March 1976 by the Secretary of the Army. This report, completed in October 1974, recommended that the existing project be enlarged to provide, in general, for channel depths of 42 feet in the outer bar and jetty channel, 40 feet in Charleston Harbor and 38 feet in Shipyard River. Additional channel and basin widening were also included in the recommended plan. These improvements were deemed necessary to meet the expected harbor growth and provide for safe navigation while minimizing undesirable effects on the environment of the area. The benefits that would accrue from the implementation of these improvements would be derived from savings in transportation costs by the use of larger vessels and reductions in existing hazards to navigation.

The Phase I AE&D Studies on Charleston Harbor were authorized by the 94th Congress in Section 101 of the Water Resources Act of 1976. This authorization required the Charleston District to review the data contained in the review of reports and changes which have taken place which would affect the formulation as presented in the report. The project was formulated in accordance with the Water Resource Council's "Principles and Standards for Planning Water and Related Land Resources."

The steps necessary to implement the navigation plan of improvement for Charleston Harbor and Shipyard River, as recommended in this Phase I AE&D Study, can be summarized as follows:

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Review of the report by the Corps of Engineers' South Atlantic Division, the Board of Engineers for Rivers and Harbors, and the Office of the Chief of Engineers.

The Chief of Engineers transmits the report to the Governor of South Carolina and interested Federal agencies for formal review and comment. Following the above state and interagency review, the final report of the Chief of Engineers would be forwarded to the Secretary of the Army. The Secretary would then seek the comments of the Water Resources Council. The function of the WRC review is to advise the agency head and OMB, through an impartial statement of review findings, whether the plan or project is in consonance with the Principles and Standards, the President's Water Resources Policy initiatives, and the forthcoming WRC planning procedures manual. The WRC review will be independent of the review and analysis by OCE, the staff of the Assistant Secretary of the Army for Civil Works and OMB.

Congressional authorization of modification of the Charleston Harbor deep-water navigation project would then be required. This procedure would include appropriate review and hearings by the Public Works Committees.

If the project is authorized, the Chief of Engineers would then have to include funds for the Phase II AE&D studies and for plans and specifications.

If the Congress appropriates the necessary initial funds, formal assurances of local cooperation would be requested from non-Federal interests.

Plans, specifications, and a detailed engineering estimate of cost would then be prepared by the District Engineer, bids invited, and a contract awarded. At this time, the necessary local actions would be required.

It is not possible to accurately estimate a schedule for the above steps. However, once the project is authorized and initially funded, it would be possible to complete design and construction within four years if subsequent appropriations were forthcoming as needed.

Problem Identification

The selection of the best plan of improvement for Charleston Harbor involved the comparison of the various alternatives which met the formulation and evaluation criteria outlined earlier. Consideration was given to environmental effects, social well-being, the regional development and the national economic development. During the preauthorization studies, all alternatives were presented for public consideration and evaluation at the Plan Formulation Public Meeting held in Charleston on 20 June 1974. The plans considered in this report were presented at a public meeting held 5 February 1980.

NATIONAL OBJECTIVE

The Water Resource Council's "Principles and Standards" (P & S) require that Federal and Federally-assisted water and related land planning be directed to achieve National Economic Development (NED) and Environmental Quality (EQ) as equal national objectives. NED is to be achieved by increasing the value of the nation's output of goods

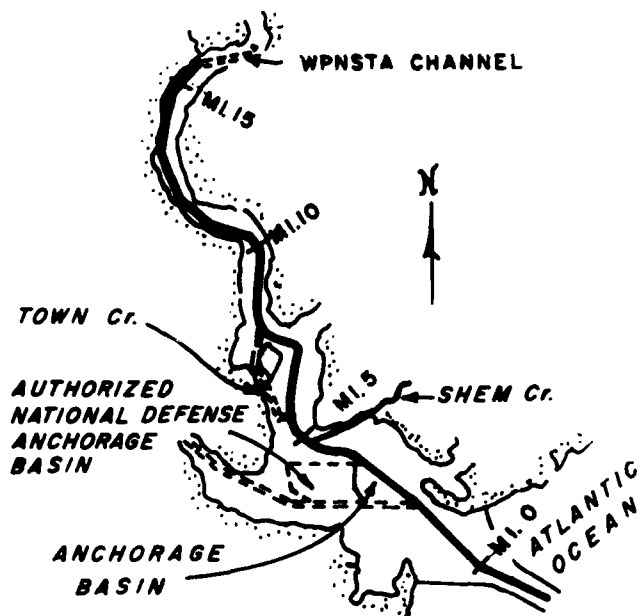
and services and improving national economic efficiency; EQ is to be achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. For this study the National Economic Development will be achieved by reducing the average transportation cost for commerce shipped through Charleston Harbor. Within the limited scope of the Phase I study, there was no opportunity for major environmental enhancement objectives; however, methods were investigated and incorporated into the study which lessen the impacts on the environment, particularly those associated with the disposal of dredged material.

In addition to the above, Principles and Standards require that impacts of proposed actions on the Regional Development (RD) and Social Well-Being (SWB) of the area be evaluated. The effect on the regional development comes from the increase in future development of existing industry and the attraction of new industry to the area. Social well-being of the area will be determined primarily by the effect on real income for the people in the area.

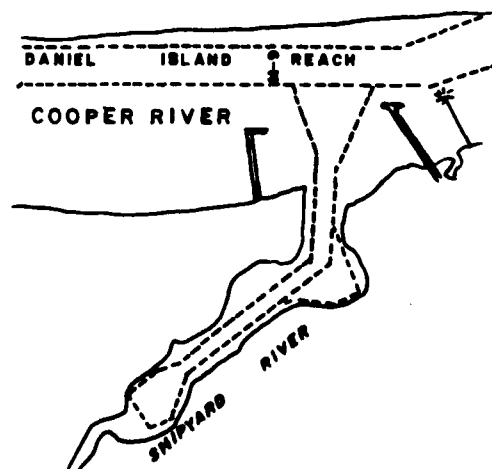
EXISTING CONDITION

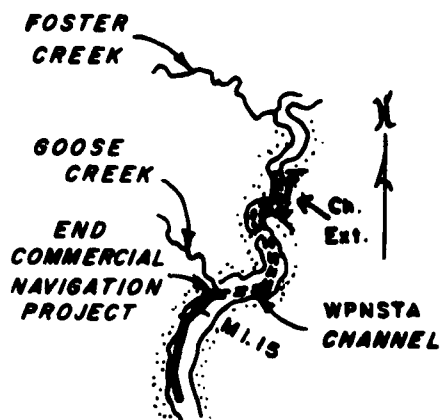
The existing authorizations for Charleston Harbor provide for Navy and commercial navigation consisting of: (a) a commercial channel 35 feet deep from the Atlantic Ocean to the Navy Ammunition Depot (NAD)

channel (mile 15.6) with varying widths; (b) a channel 35 feet deep and 500 feet wide through Town Creek; (c) a connection channel 10 feet deep from Shem Creek to the Atlantic Intracoastal Waterway; (e) a 40-foot National Defense channel from the 40-foot ocean contour to the Commandant's wharf (mile 12.6) with varying widths and an anchorage basin 30 feet deep located between Shutes Folly Island and Fort Sumter, to be prosecuted only as found necessary in the interest of national defense. All project features have been completed except for the 40-foot national defense channel. The Charleston Harbor project is shown on Plate 1 with the various reaches being shown in greater detail on Plate 2-4.



The existing authorizations for the Shipyard River provide for commercial navigation with a 30-foot project from the Cooper River to the Airco Alloys and Carbide Inc. plant on Shipyard River including two turning basins, one opposite the Gulf Oil Corporation terminal and another at the upper end of the project. Plate 5 shows the Shipyard River project.





The Naval Weapons Station (WPNSTA) channel extends from the head of the authorized commercial navigation project (vicinity of Goose Creek) upstream 3.48 miles. A channel for the U. S. Navy Noise Measurement Facility extends from the end of the WPNSTA channel 1.0 mile upstream. Both of these channels have a project depth of 35 feet with varying widths.

The Cooper River Rediversion Project was authorized by the River and Harbor Act of 1968 with the view of substantially reducing harbor shoaling. Construction of this project will red divert to the Santee River the major portion of the freshwater originating in the Santee River basin and currently passing through the Pinopolis Hydroelectric Power Plant into the Cooper River and Charleston Harbor. Rediversion of this freshwater flow would reduce the current average discharge of 15,600 cfs at Pinopolis to a non-damaging average of 3,000 cfs. The 3,000 cfs discharge is that flow previous investigations indicated to be a tolerable flow which will not result in harmful sediment trapping density currents. Construction on this project has been initiated and is currently scheduled for completion late in 1983.

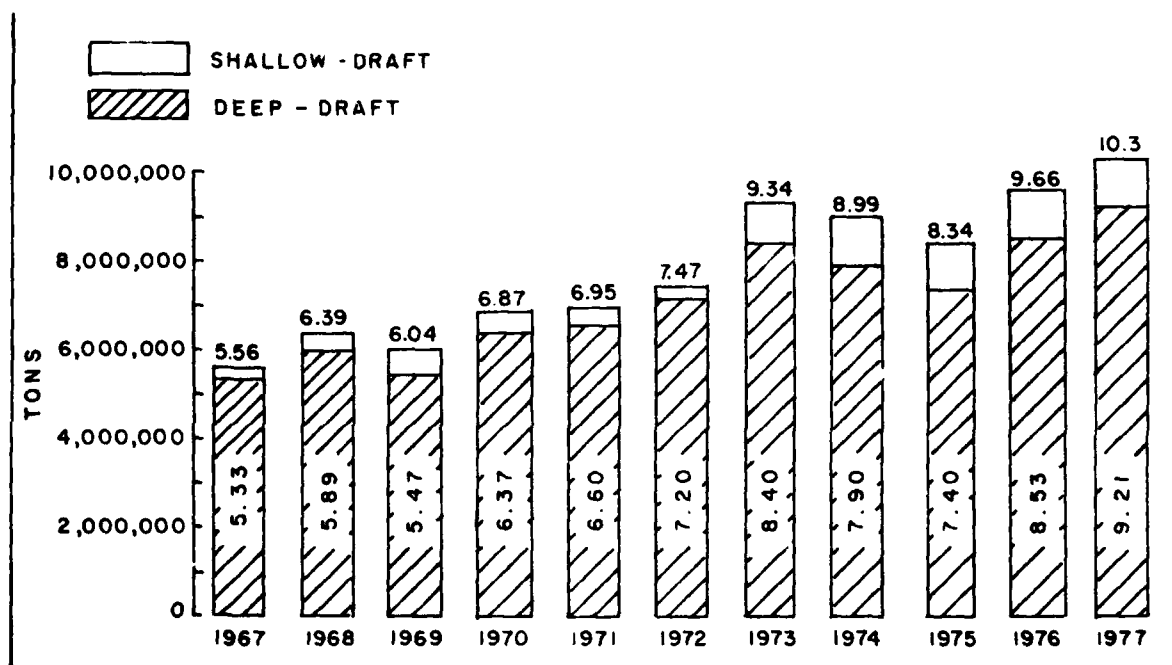
CONDITION IF NO FEDERAL ACTION IS TAKEN

If no Federal action is taken, the port will no longer operate as efficient as other deeper ports along the east coast. This would worsen with each passing year as the vessel size becomes more acute with the continual removal of the smaller vessels from the available world shipping fleet. The lack of sufficient depth will severely limit the ability of

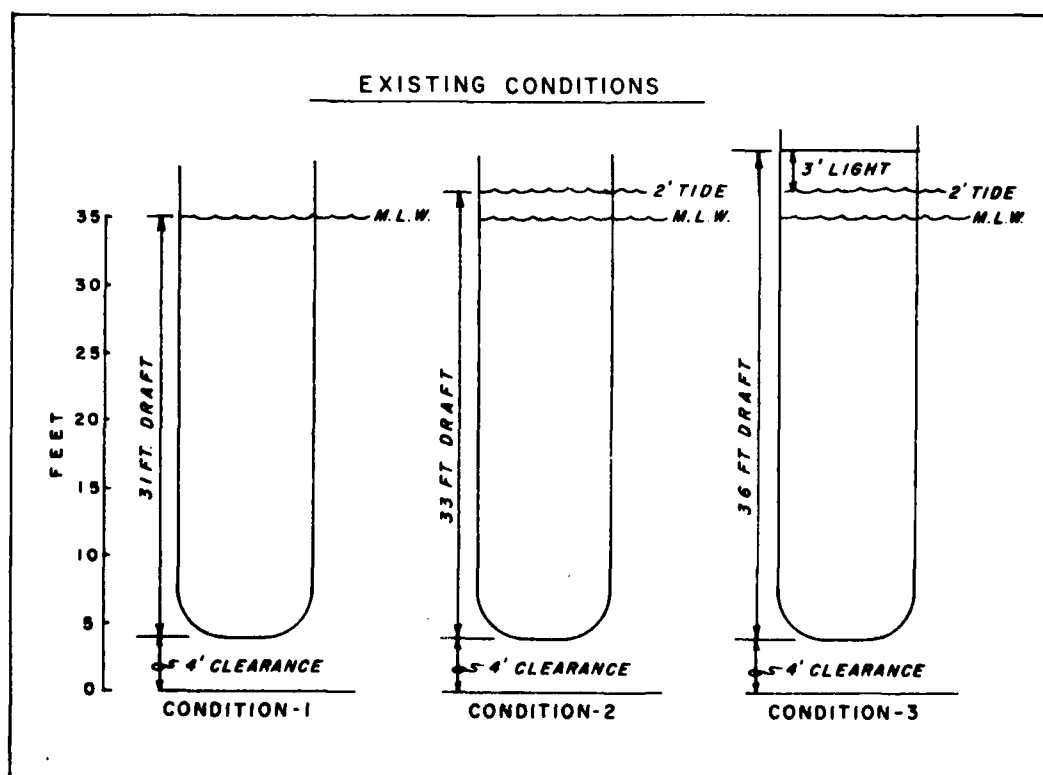
Charleston Harbor to accommodate the demands of its many diversified dependents. Thus the port will stagnate economically, adversely affecting the maritime contribution to local and state economy.

PROBLEMS, NEEDS AND OPPORTUNITIES

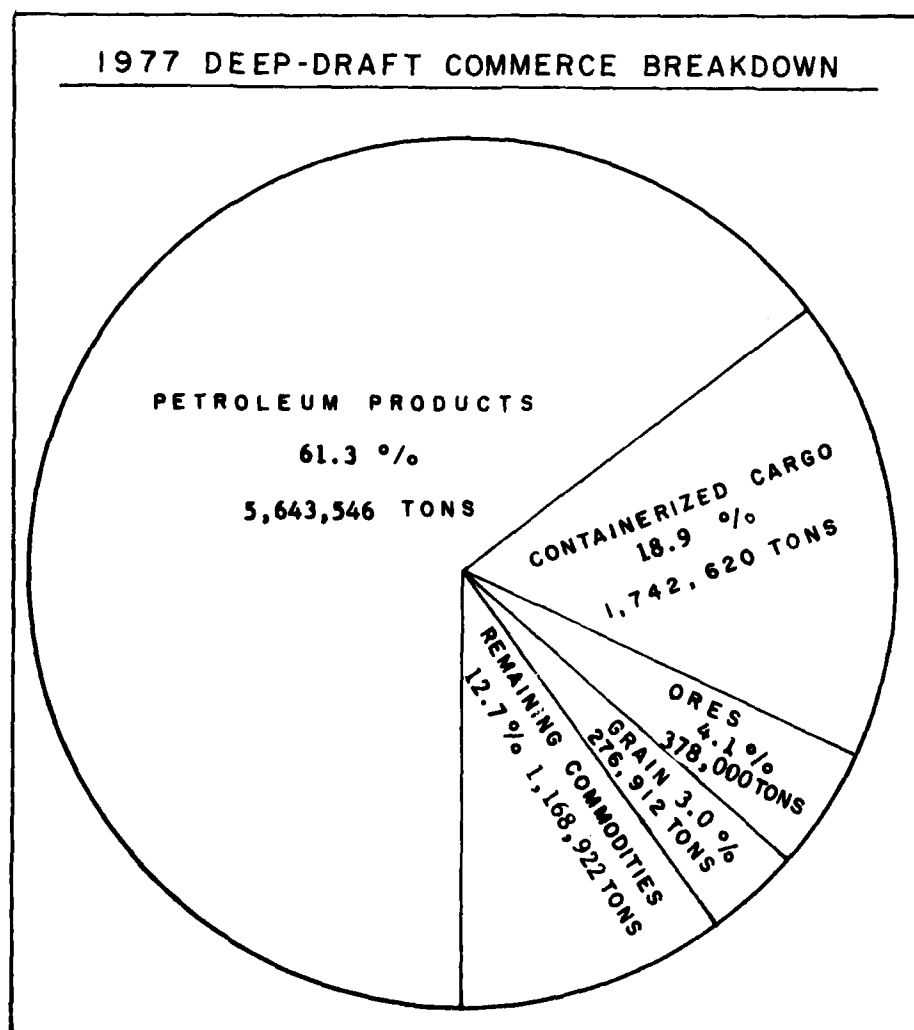
The growth in waterborne commerce through Charleston Harbor over the past decade reflects the rapid economic development of the South Atlantic region and the State of South Carolina. While there have been fluctuations in the volume of waterborne commerce through the port, the overall trend has been upward. The volume of commerce has increased from 5,564,670 tons in 1967 to 10,327,659 tons in 1977. The chart below illustrates the annual growth during this period.



A study of the existing and prospective commerce on the waterway reveals that the existing channel is inadequate for deep draft vessels capable of handling numerous categories of commerce (petroleum, ores, grain and container cargo). As a result, many of the vessels are transiting the waterway light loaded, having to make use of the tides or both. The current authorized project depth of 35 feet m.l.w. for Charleston Harbor restricts the safe passage of vessels over the waterway to those having a loaded draft up to 31 feet. A four-foot clearance is considered necessary between the vessel keel and channel bottom to insure maneuverability and safety. Therefore, vessels with drafts of greater than 31 feet must utilize tidal advantage and/or light loading to safely transit the waterway. Either of the methods, of course, will increase the transportation cost of the commodity being shipped.



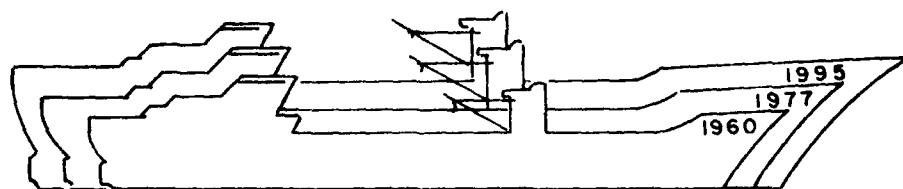
A need for greater depths to accommodate tankers, ore carriers and container vessels is apparent. The need will even become more apparent as the small vessels now available in the world fleet become uneconomical to operate due to the rapidly increasing cost of energy. The vessels, then, in turn are being replaced by larger vessels which cannot operate at top efficiency over the existing waterway. The chart shown below reveals that the types of vessels requiring greater channel depth handles 87% of the commerce shipped in deep draft vessels.



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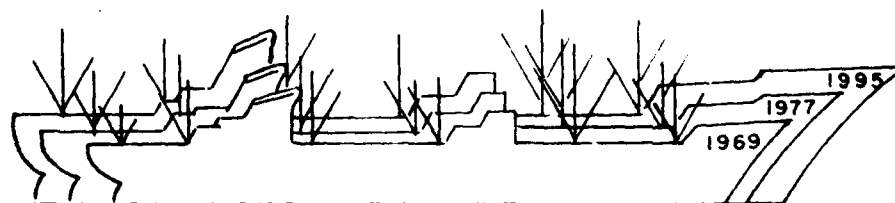
The vessels using Charleston Harbor are not only increasing in draft but length as well . The increase in average vessel length is illustrated below. This increase in vessel length and the projected increasing trend in longer vessels has made the need for enlargement of the various basins apparent.

AVERAGE SIZE TANKER - CHARLESTON HARBOR



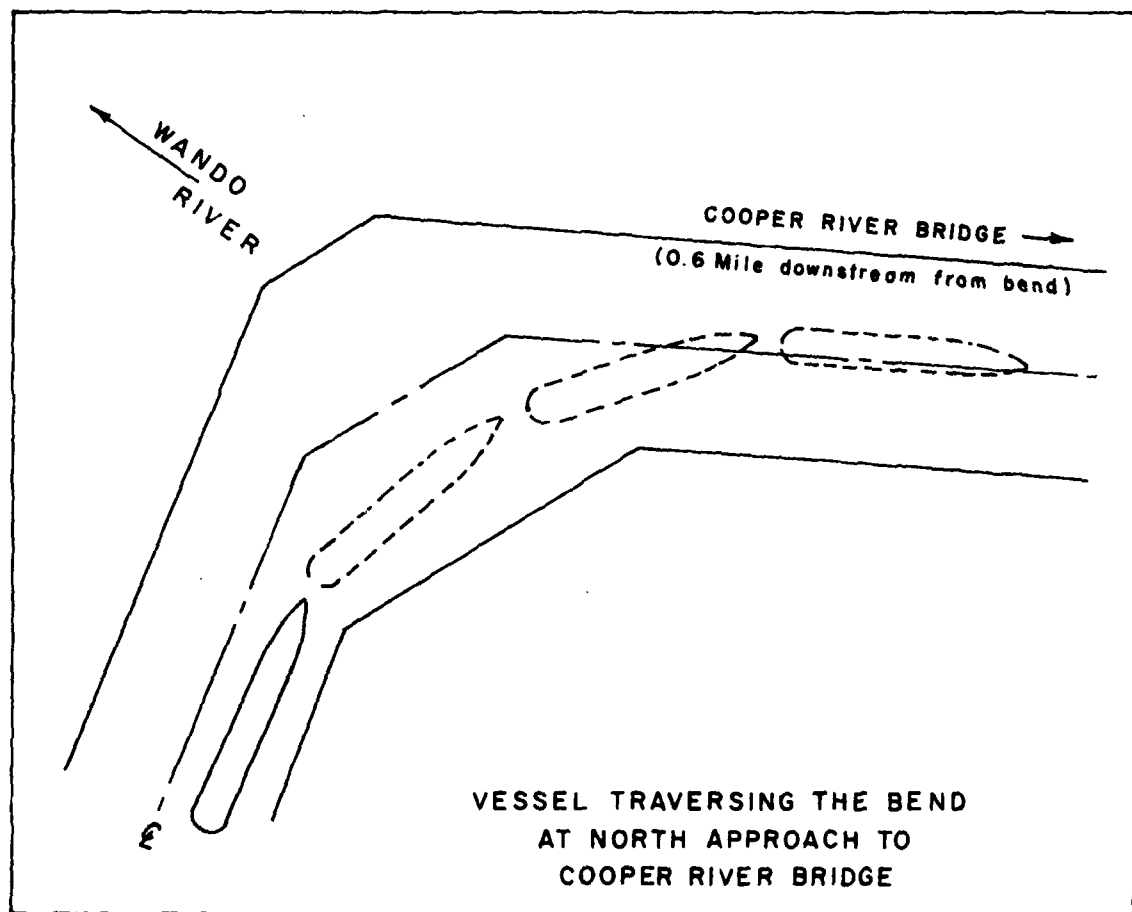
1960	1977	1995
31 FOOT DRAFT	33 FOOT DRAFT	37 FOOT DRAFT
20,000 D.W.T	25,400 D.W.T.	37,000 D.W.T.
560 FOOT LENGTH	610 FOOT LENGTH	690 FOOT LENGTH

AVERAGE SIZE CONTAINERSHIP - CHARLESTON HARBOR

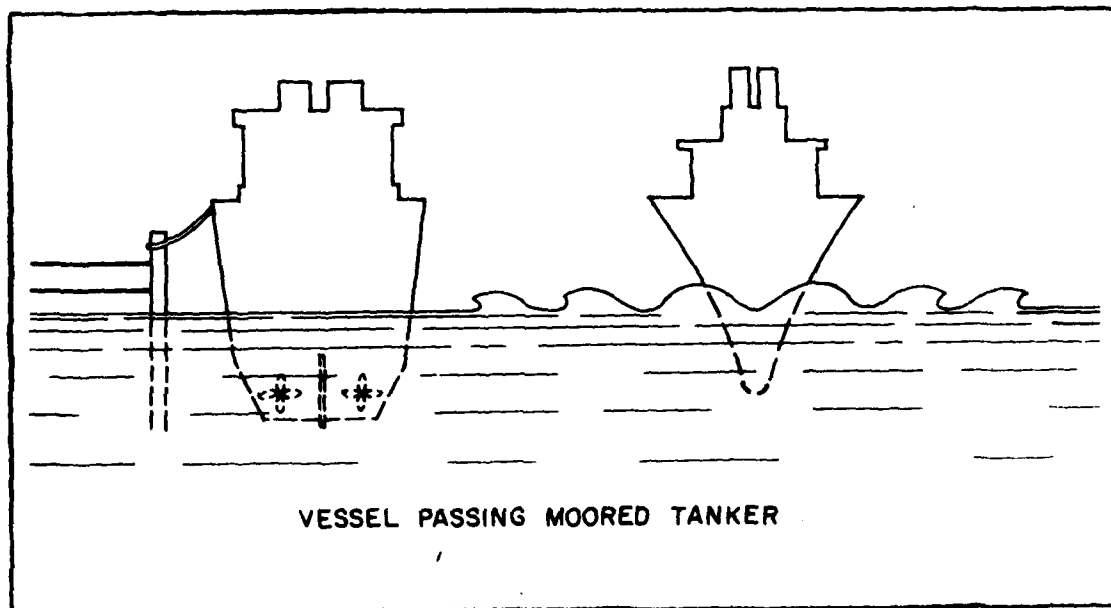


1960	1977	1995
30 FOOT DRAFT	31 FOOT DRAFT	32 FOOT DRAFT
14,000 D.W.T	15,400 D.W.T.	17,200 D.W.T.
550 FOOT LENGTH	660 FOOT LENGTH	700 FOOT LENGTH

A 70° bend in the Cooper River Channel, approximately 0.6 mile above the Cooper River Bridges, creates a hazardous condition for vessels going downstream, especially during adverse weather conditions and/or when a vessel is approaching the bridges from the opposite direction. There have been no recorded collisions at this location; however, there have been a number of close calls. The U. S. Coast Guard, U. S. Navy and the Charleston Harbor Pilots Association have expressed an urgency in easing this bend.



Another hazardous condition exists along the Filbin Creek and North Charleston Reaches, commonly referred to as "tankers row". Numerous tanker facilities are located adjacent to these reaches. Previous Federal policy allowed these facilities to extend to the Federal navigation project, such that when vessels are moored at these facilities, they extend up to 100 feet into the authorized channel. This condition creates a hazard not only to passing vessels, but to the moored tankers as well. The waves created by the passing vessels have caused the mooring lines to break. No collisions have been reported to date, but such a disaster is a possibility as long as these conditions exist.



Impacts on the Flood Plain. As directed by Executive Order 11988, the long and short term impacts associated with the occupancy and modification of the flood plain were investigated. The proposed project would

not increase the size of the flood plain, however, it would encourage waterfront growth in the flood plain. Much of the future development would occur with or without the project modifications. The development of the waterfront portion of the flood plain is necessary if port growth is to continue.

The opportunity for marsh building as set forth by Section 150 of the Water Resources Development Act exists in Charleston Harbor; in fact, open water disposal in previous years has resulted in higher elevations and the unexpected growth of marsh where none previously grew. In each of these cases, however, the Corps was asked to halt this disposal in open waters. Among the issues raised by State and Federal agencies were loss of navigation, recreation, fisheries, and water quality. When the Charleston District proposed to create over 300 acres of marsh in Winyah Bay (an area with a small marsh/open water ratio), the State and Federal wildlife agencies did not like the fact that this was to be achieved at the expense of open water habitat. They pointed out at that time that these are different but equally important habitats. Fifty acres of Winyah Bay is to be converted from shallow water to marsh as an experiment and then evaluated before this disposal method is expanded to other areas in the State. Because there exists almost no objective, quantitative data on the ideal ratio of marsh to open water, and because of the present position of the fish and wildlife agencies, marsh building is not a practical solution for the disposal of the large amounts of material that would be removed during the construction and maintenance of a 40-foot project.

Water Quality. Charleston Harbor is classified by the State of South Carolina as "SC" waters, which means that various uses such as shellfishing and recreation involving direct water contact are not recommended. In recent years, there has been an improvement in the water quality of Charleston Harbor due to tighter discharge requirements on point sources, especially sewage treatment and industrial wastes. On the other hand, growth of the urban areas in and north of Charleston has created a much larger number of "area" sources such as runoff from roads and parking lots and small, illegal discharges of wastes by individuals. Water quality (in terms of its suitability for shellfishing, direct water contact and other "SA" uses) is expected to remain poor in Charleston Harbor for many years.

Studies in Charleston harbor show that, with the exception of short-term increases in turbidity, maintenance of Charleston Harbor does not alter ambient water quality. Programs for the control of water quality on a large scale are administered by the South Carolina Department of Health and Environmental Control; by EPA through grants to the state and to municipalities, and through direct permitting; by the U. S. Coast Guard; and by local agencies through local permits, zoning, etc.

Impacts of Urban Growth. As population and construction activities increase in the Charleston area, the amount of fish and wildlife habitat and other undeveloped areas is expected to decrease, with or without the harbor deepening. This assumption is based on economic and population projections, and the degree of willingness shown in the past by zoning and permitting authorities to restrict or limit growth in these areas. Similarly, industrial and residential development by private groups and individuals will probably continue to take place on lands of historical or prehistorical importance where these lands or the private actions are not subject to Federal or state control.

The major decisions which determine large-scale land use are not within the scope of the current deepening study. Such decisions depend upon adequate zoning laws and a commitment by local officials to enforce the zoning; broad regional planning such as that contained in the South Carolina Coastal Management Program; and the control of growth through grants and permits administered by EPA, the South Carolina Department of Health and Environmental Control, and local permitting authorities; all of which are designed to prohibit disorderly growth and unwise use of natural resources.

Because of the limited scope of the Phase I authorization and the absence of feasible alternatives in the Phase I stage, and because the Charleston area's large scale land use and water quality problems are not within the Corps control, efforts to address environmental problems and needs in the Phase I study were concentrated in two categories:

(1) Options were examined which minimized the impacts on water quality, fish, wildlife, cultural sites and other natural resources.

(2) Where impacts could not be totally avoided, options were studied to make sure that the deepening project would not significantly add to the area's environmental problems and to prevent the destruction or permanent alteration of important resources.

PLANNING CONSTRAINTS

Since Charleston Harbor is an existing navigation project, alternatives which fulfill project needs are limited. A number of alternatives to channel modification were discussed in the survey report and none of the solutions offered a viable solution to all project needs.

A review of the alternatives substantiated these views. Solutions to hazardous conditions which affect the navigability of the existing waterway are also limited as the channel alignment is virtually fixed. Various factors contributing to this situation are the development of the west bank, the bridge across the waterway and the islands located in the harbor of historical and environmental value.

Although the dredging industry has been making great advances in converting their existing equipment to permit pumping a more dense mixture and thereby making bargeing to sea an economic alternative, it is not known whether or not sufficient equipment will be available at the time of construction (initial deepening). In addition, the study authority does not provide a method for acquiring disposal areas during the present phase of planning. For these reasons it is impossible to make a final decision on the method of disposal or the exact location of disposal sites. Therefore, the environmental impacts were assessed for both ocean and upland disposal of dredged material. For upland disposal, the assessment was made on the most likely potential sites. These uncertainties, however, do not affect the feasibility of the project.

PLANNING OBJECTIVES

Planning objectives are the national, state and local water and related land resource management needs specific to a given study area that can be addressed to enhance the National Economic Development (NED) or the Environmental Quality (EQ). The planning objectives established for Charleston Harbor are as follows:

Provide for the most economic and environmentally acceptable means of getting commodities into and out of Charleston.

Provide safe navigation for vessels utilizing the waterway.

Provide sufficient turning area and anchorage for the vessels which will use the waterway.

Minimize the adverse environmental impacts and, where possible, improve existing conditions.

Formulation Of Preliminary Plans

ALTERNATIVES

Formulation of preliminary plans were discussed in the survey report. These plans include a lighterage system, offshore ocean terminal, a terminal at Cummings Point, light load at other ports and pipeline from source. A review of these plans indicate that none of the alternatives were viable in terms of meeting the physical and monetary requirements.

CHANNEL MODIFICATION

Channel modification was also considered in the survey report. Channel depths of 38, 40, 42, and 45 feet were considered for Charleston Harbor and 35, 38, 40 and 42 feet for Shipyard River. An analysis of the annual costs and benefits for deepening the waterway to these various depths reveals that the benefits maximize at 40 feet for Charleston Harbor and 38 feet for Shipyard River. A re-analysis of the current annual charges and annual benefits reveals that the benefits still maximize at 40 feet for Charleston Harbor and 38 feet in Shipyard River. Table 1 shows a summary of the cost and benefit of the various channel depths. The maximization of benefits is discussed in detail in Appendix D and is illustrated in the drawing below.

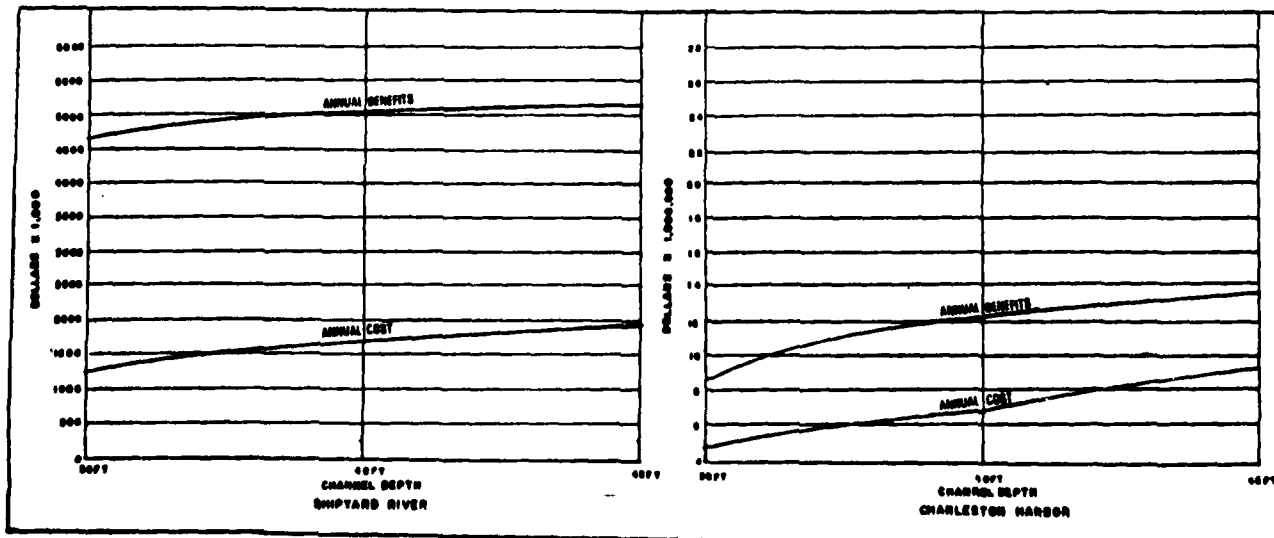


TABLE 1
SUMMARY OF ANNUAL CHARGES AND BENEFITS (IN \$1,000)^{2/}

Item	Project Depth	Annual Cost	Annual Benefit	Excess Benefit Over Cost	Benefit-to-Cost Ratio
Shipyard River	30-35	772	3,235	2,463	4.19
	35-38 ^{1/}	483	1,396	913	2.89
	35-40 ^{1/}	920	1,792	892	1.95
	35-42 ^{1/}	1,148	1,897	769	1.68
Cooper River	35-38	4,570	8,541	3,971	1.87
	35-40	6,702	12,153	5,451	1.81
	35-42	9,068	13,635	4,567	1.50
Total Waterway	35-38 ^{1/}	5,053	9,937	4,884	1.97
	35-40 ^{1/}	7,622	13,945	6,323	1.83
	35-42 ^{1/}	10,216	15,532	5,316	1.52

^{1/} Considers the incrementally deepening of Shipyard River from 35 feet.

^{2/} Costs are based on pipeline dredging with upland disposal areas on Daniel Island.

Assessment And Evaluation Of Detailed Plans

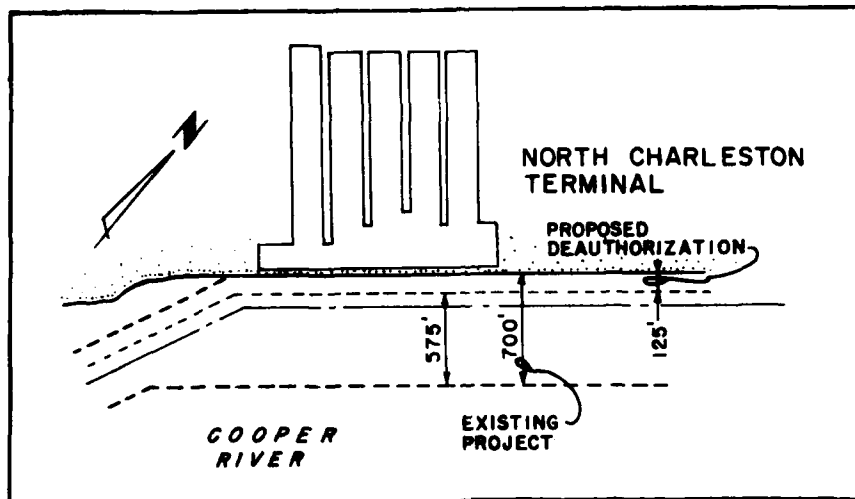
Eight different plans were assessed and evaluated for this report, which include four separate plans for Charleston Harbor and Shipyard River. These plans were a no action plan; light loading at Wilmington and/or Savannah; channel modification with upland disposal and channel modification with ocean disposal.

The no action plan and the nonstructural, that is light loading at Savannah and/or Wilmington do not meet the study objectives and were eliminated in the preliminary planning stage. These plans are shown in the Systems of Accounts Table; however, they will not be discussed further in this report as these plans are not viable solutions. The no action plans for Charleston Harbor and Shipyard River are Plans 1 and 5 respectively, while the nonstructural plan for Charleston Harbor and Shipyard River will be Plans 2 and 6.

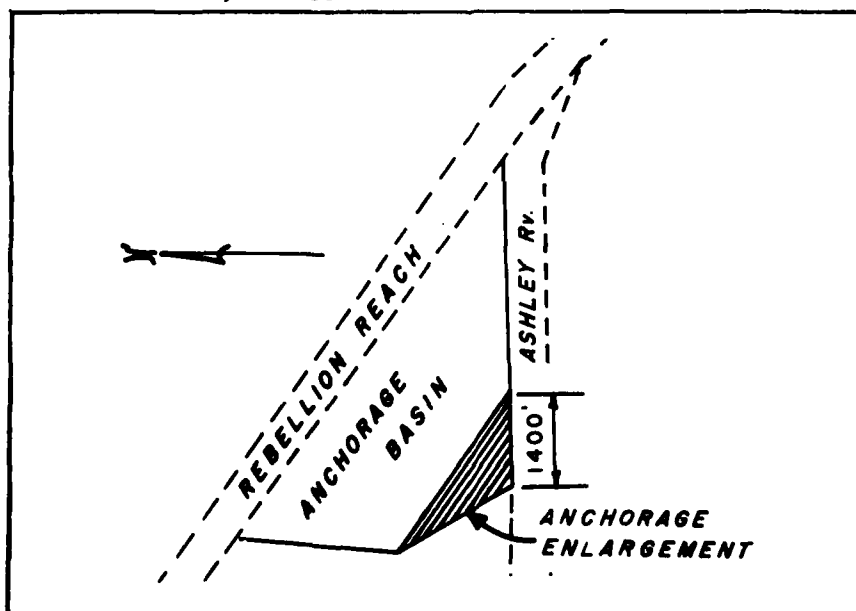
PLAN 3

Plan Description. Plan 3 consists of deepening the existing Charleston Harbor project from 35 feet to 42 feet in the entrance and jetty channels and from 35 feet to 40 feet in the inland channels, turning areas and anchorage basin (Shipyard River Project excluded). In addition to the channel deepening, Plan 3 includes the following:

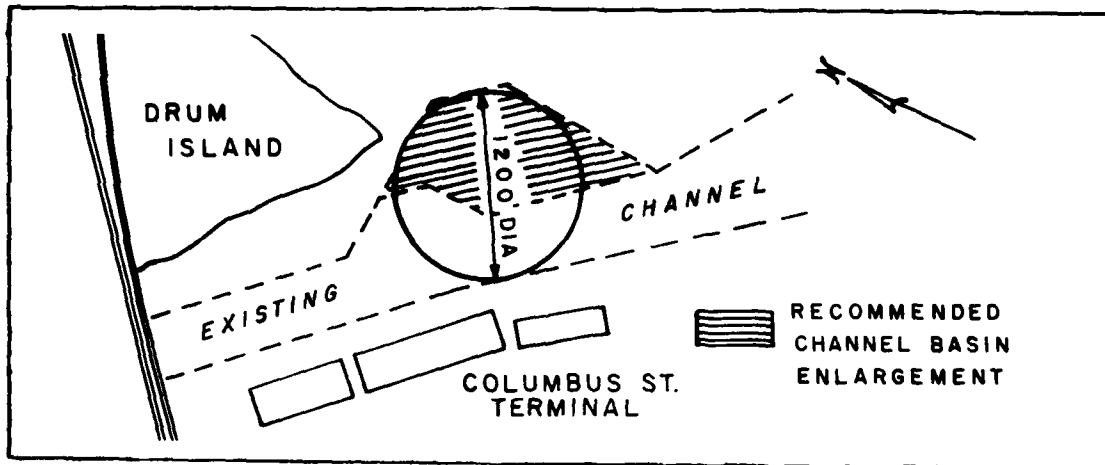
Realignment of the channel centerline to provide 125 feet between existing docks, piers, etc., and the edge of the channel.



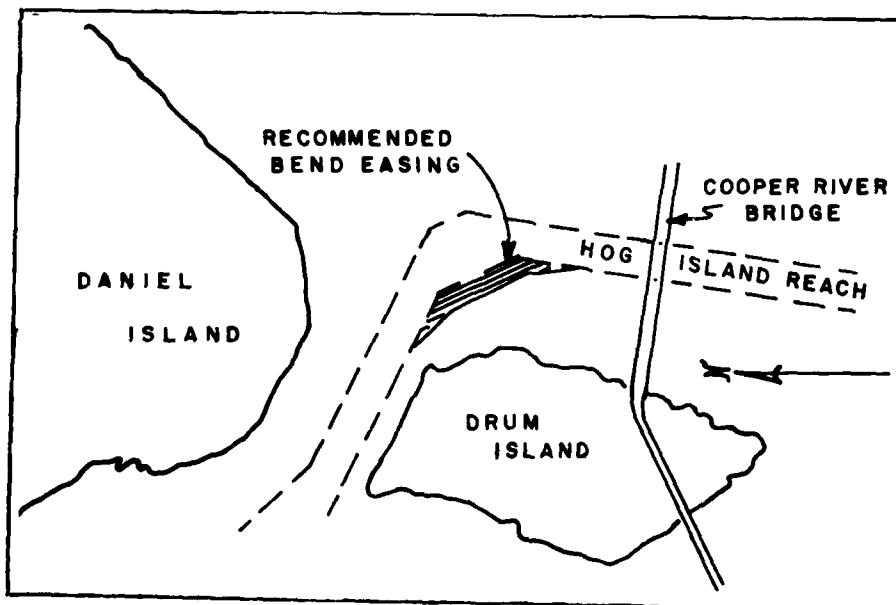
Enlargement of the anchorage basin by extending the south side of the basin 1,400 feet.



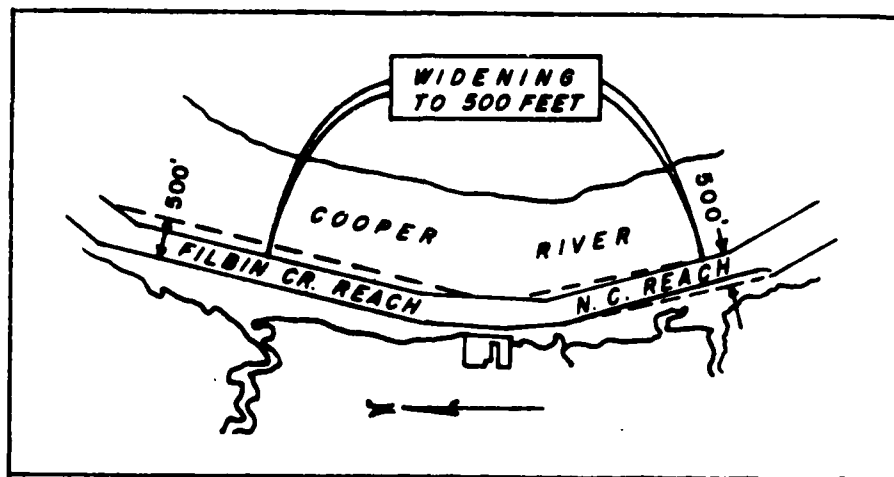
Modification of the turning basin adjacent to the Columbus Street docks with a turning diameter of 1,200 feet.



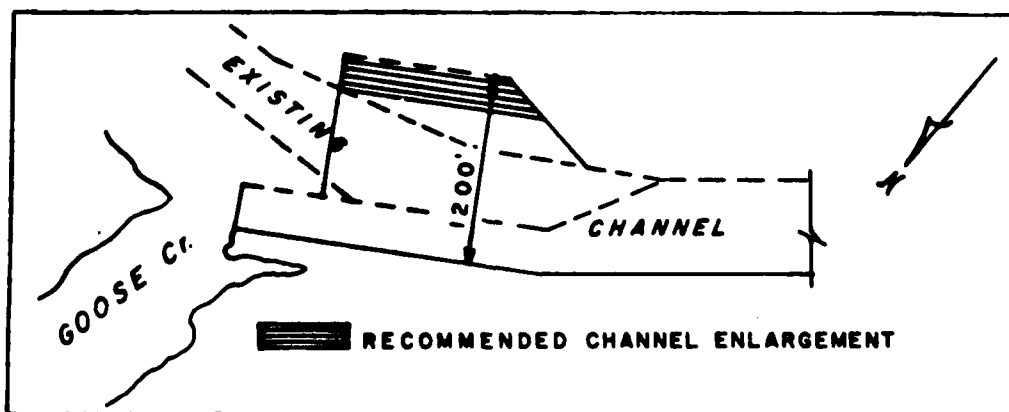
Easing of the bend at the northern approach to the Cooper River Bridge.



Widening of the Filbin Creek and North Charleston reaches to 500 feet.



Enlargement of the existing turning basin at the head of commercial navigation (Goose Creek) to provide a 1,200-foot diameter.



Disposal of Material. The jetty and entrance channels will be deepened by hopper dredge with the dredged material being dumped in an EPA-approved ocean site. The inland channels will be enlarged by a pipeline dredge with the dredged material from the anchorage basin being placed on Morris Island and all other material being placed in upland areas on Daniel Island. Potential areas are shown on Figure 1. The exact location of these areas will be determined at a later date. Consideration was also given to using the material in the entrance channel for beach nourishment on Folly Beach. Hopper dredges with pumpout capability have been used to nourish beaches at other east coast projects in recent years. However, due to longer pumping distances at Folly Beach, this operation is not economical at this time. Beach nourishment as a means of disposal of material will be reconsidered during Phase II studies.

Impact Assessment. An environmental impact statement which describes the effects of the proposed project in detail was prepared in April 1976. The only impacts which can be attributed to the deepening plans are those which would occur in addition to those now occurring due to the annual maintenance of the existing 35-foot project.

Water quality impacts associated with both the existing and the deeper projects include temporary and localized increases in turbidity and some dissolved materials; however, bioassays and elutriate tests indicate that there would be no violation of state standards or long-term impacts. The minor losses of fishes and benthic organisms (no significant losses have been demonstrated due to O&M work) near the dredge and disposal areas would continue with annual dredging, but would be slightly greater in proportion to the amount of dredging required by the deeper and the existing projects. The area dredged is a relatively small portion (about 1/40th) of the total estuarine area, and recovery of the benthic populations begins shortly after dredging. The difference between the impacts of the existing 35-foot project and the proposed deeper project, in terms of water quality and estuarine organisms, is not significant. See also the FEIS and the 404(b)(1) evaluation of this report.

The major impact of Plan 3 would be the removal of approximately 923 acres of valuable farmlands, woodlands and wildlife habitat from productive uses for periods ranging from three years (open acres) to 30 to 40 years (mature hardwoods). See the evaluation of upland sites on page 79 of this report.

Implementation Responsibilities.

Cost Allocation - The estimated first cost and annual charge for Plan 3, based on February 1980 prices, are summarized in Table 2. An allowance of 15 percent for contingencies is included. All estimates include engineering and design, and supervision and administration, based on the cost of these for similar projects. The life of the project is considered to be 50 years. Interest and amortization charges are based on the above-mentioned interest rate of 7-1/8 percent. The annual charges also include the estimated annual maintenance dredging. The Federal and non-Federal first costs have been adjusted to reflect the requirement that the State of South Carolina pay 5% of total first cost of the project in addition to the normal items of local cooperation.

Federal Responsibilities - The United States would design and prepare detailed plans, dredge the improved channels and turning basins, maintain the improved channels to project dimensions, and provide and maintain necessary aids to navigation, after Congressional authorization and funding and after the non-Federal requirements have been furnished.

The presently estimated Federal share of the total first cost of Plan 3 is \$44,347,000 and equivalent to about 85 percent of the total. The estimated Federal annual charge is \$5,877,000 of which \$2,612,000 is for the additional annual maintenance dredging.

TABLE 2
PLAN 3
SUMMARY FIRST COST AND ANNUAL CHARGES
(COOPER RIVER - UPLAND DISPOSAL)

ITEM	COST	
<u>FIRST COSTS</u>		
<u>Federal</u>		
Dredging	\$46,922,000	
Navigation Aids	<u>20,000</u>	
Subtotal	\$46,942,000	
<u>Non-Federal</u>		
Levee & Spillways	\$ 2,298,000	
Disposal Areas	<u>2,058,000</u>	
Berthing Areas	<u>609,000</u>	
Subtotal	\$ 4,965,000	
Total First Cost	\$51,907,000	
	<u>Proposed</u>	<u>Existing</u>
	<u>Cost Allocation</u>	<u>Cost Allocation</u>
<u>SUMMARY OF ADJUSTED FIRST COST</u>		
Federal	\$44,347,000 (1)	\$46,942,000
Non-Federal	<u>7,560,000 (2)</u>	<u>4,965,000</u>
Total Adjusted First Cost	\$51,907,000	\$51,907,000
<u>ANNUAL CHARGES</u>		
<u>Federal</u>		
Federal First Cost	\$44,347,000	\$46,942,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Federal Investment	\$44,347,000	\$46,942,000
Interest at 7-1/8%	\$ 3,160,000	\$ 3,345,000
Amortization @ .2357%	<u>105,000</u>	<u>111,000</u>
Maintenance	<u>2,612,000</u>	<u>2,612,000</u>
Total Federal Annual Charges	\$ 5,877,000	\$ 6,068,000
<u>Non-Federal</u>		
Non-Federal First Cost	\$ 7,560,000	\$ 4,965,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Non-Federal Investment	\$ 7,560,000	\$ 4,965,000
Interest at 7-1/8%	\$ 539,000	\$ 354,000
Amortization @ .2357%	<u>18,000</u>	<u>12,000</u>
Maintenance	<u>268,000</u>	<u>268,000</u>
Total Non-Federal	\$ 825,000	\$ 634,000
<u>TOTAL ANNUAL CHARGES</u>		
Federal	\$ 5,877,000	\$ 6,068,000
Non-Federal	<u>825,000</u>	<u>634,000</u>
Total Annual Charge	\$ 6,702,000	6,702,000

- (1) \$46,942,000 - (\$51,907,000 x .05)
(2) \$4,965,000 + (\$51,907,000 x .05)

Non-Federal Responsibilities - Local interest will be required to:

a. Provide without cost to the United States all lands, easements and rights-of-way required for construction and subsequent maintenance of the selected or interim plans of improvement and for aids to navigation upon the request of the Chief of Engineers to be required in the general public interests for initial and subsequent disposal of dredged material, as well as the necessary retaining dikes, bulkheads and embankments or the cost of such works;

b. Hold and save the United States free from damages that may result from the construction and maintenance of the project, except damages due to the fault or negligence of the United States or its contractors;

c. Provide and maintain without cost to the United States adequate public terminal and transfer facilities open to all on equal terms;

d. Provide and maintain without cost to the United States depths in berthing areas and local access channels serving the terminals commensurate with the depths provided in the related project areas;

e. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities and other structures and improvements made necessary by the construction;

f. Prohibit erection of structures within 125 feet of the bottom edge of the recommended Federal project channels or turning basins.

In addition to the above, the State of South Carolina will be required to make a cash contribution equal to 5% of the first costs of construction of the project.

The presently estimated non-Federal share of Plan 3 is \$7,560,000. Annual charges are estimated at \$825,000, of which \$268,000 would be for annual maintenance.

PLAN 4

Plan Description. Plan 4 also consists of deepening the existing Charleston Harbor project from 35 feet to 42 feet in the entrance and jetty channels and from 35 to 40 feet in the inland channels, turning areas and anchorage basins. The channel and basin enlargements contained in Plan 3 are also included in Plan 4. The only difference in the two plans is the method of disposal.

Disposal of Material. The implementation of Plan 4 will require removal of the material by a special dredge, pumping the dredged material into hopper barges located alongside the dredge and transporting the material to the Atlantic Ocean by the barges for disposal in specified areas.

Impact Assessment. The impacts of Plan 4 are identical to Plan 3, with the exception of the effects in and around the upland disposal areas used in Plan 3. There would be a short-term impact on water quality and benthic organisms at the EPA-approved dump site; however, bioassays, benthic studies and sedimentologic studies indicate that there would be no significant acute or long-term adverse impacts. See the summaries of ocean studies on page 93 of this report.

Implementation Responsibilities:

Cost Allocation - The estimated first cost and annual charges for Plan 4, based on February 1980 prices, are summarized in Table 3. Cost considerations are identical to Plan 3.

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TABLE 3
PLAN 4
SUMMARY OF FIRST COST AND ANNUAL CHARGES
(COOPER RIVER - OCEAN DISPOSAL)

ITEM	COST
<u>FIRST COSTS</u>	
<u>Federal</u>	
Dredging	\$54,879,000
Navigation Aids	20,000
Subtotal	\$54,899,000
<u>Non-Federal</u>	
Berthing Areas	\$ 899,000
Total First Cost	\$55,798,000

	<u>Proposed Cost Allocation</u>	<u>Existing Cost Allocation</u>
<u>SUMMARY OF ADJUSTED FIRST COST</u>		
Federal	\$52,109,000 (1)	\$54,899,000
Non-Federal	3,689,000 (2)	899,000
Total Adjusted First Cost	\$55,798,000	\$55,798,000

ANNUAL CHARGES

<u>Federal</u>		
First Cost	\$52,109,000	\$54,899,000
Interest During Construction	None	None
Total Federal Investment	\$52,109,000	\$54,899,000
Interest @ 7-1/8%	\$ 3,712,000	\$ 3,912,000
Amortization @ .2357%	123,000	129,000
Maintenance	1,984,000	1,984,000
Total Federal Annual Charge	\$ 5,819,000	\$ 6,025,000
<u>Non-Federal</u>		
First Cost	\$ 3,689,000	\$ 899,000
Interest During Construction	None	None
Total Non-Federal Investment	\$ 3,689,000	\$ 899,000
Interest @ 7-1/8%	\$ 263,000	\$ 64,000
Amortization @ .2357%	9,000	2,000
Maintenance	91,000	91,000
Total Non-Federal Annual Charges	\$ 363,000	\$ 157,000

TOTAL ANNUAL CHARGES

Federal	\$ 5,819,000	\$ 6,025,000
Non-Federal	363,000	157,000
Total Annual Charges	\$ 6,182,000	\$ 6,182,000

- (1) \$54,899,000 - (\$55,798,000 x .05)
(2) \$899,000 + (\$55,798,000 x .05)

Federal Responsibilities - The Federal responsibilities are identical to Plan 3. The presently estimated Federal share of the total first cost for Plan 4 is \$52,109,000 or 93% of the total estimated first cost. The estimated Federal annual charge is \$5,819,000 of which \$1,984,000 is for maintenance dredging.

Non-Federal Responsibilities - The non-Federal responsibilities are technically the same as Plan 3; however, with ocean dumping, local interest will not be required to purchase disposal areas or construct any dikes or spillways. The cost will be limited to maintaining berthing areas and providing the additional 5% cash contribution of total construction cost. The presently estimated non-Federal share of Plan 4 is \$3,689,000. Annual charges are estimated at \$363,000 of which \$91,000 is for annual maintenance.

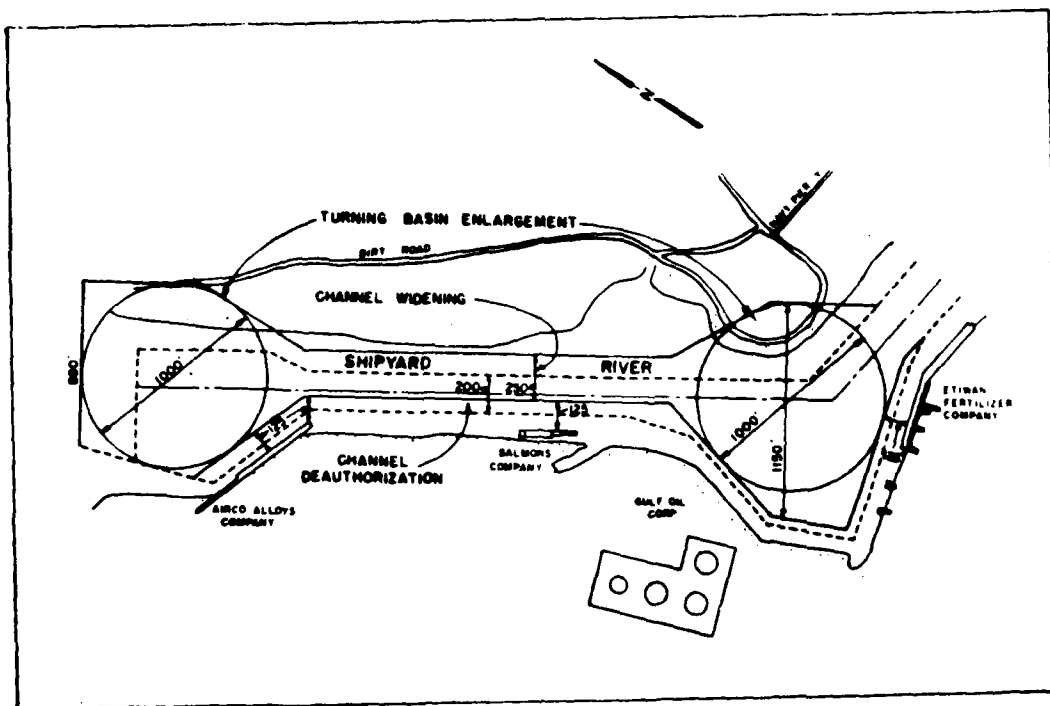
PLAN 7

Plan Description. Plan 7 consists of deepening the existing Shipyard River project from 30 to 38 feet. In addition to the channel deepening, Plan 7 includes the following:

Realignment of the channel to provide 125 feet between existing docks, piers, etc., and the edge of the channel.

Enlargement of the two turning basins to provide a turning diameter of 1,000 feet.

Widening the connecting channel to 250 feet.



Disposal of Material. This segment will be enlarged by a pipeline dredge with the dredged material being placed in upland areas on Daniel Island. The exact location of these areas will be determined at a later date; however, potential areas are shown on Figure 1.

Impact Assessment. The impacts of Plan 7 are the same as those summarized for Plan 3 with the following exceptions:

(1) Water quality and biological impacts due to dredging would take place in a small, heavily developed and unproductive creek, rather than in the larger bodies of Charleston Harbor.

(2) The contaminant levels in Shipyard River material are greater than the levels in the rest of the harbor, but are still suitable for upland disposal (See 404(b)(1) evaluation on page 58 of this report).

(3) 187 acres of farmland, woodland and wildlife habitat on Daniel Island would be required, as compared to the 923 acres for Plan 3.

(4) Less than 10 acres of land, which includes some wetlands, would be affected by the enlargement of the turning basin on Shipyard River; however, these areas are classified by the South Carolina Department of Wildlife and Marine Resources as Priority 4 wetlands, the lowest possible class, and one which has "little value to fisheries and wildlife resources" and is "unrealistic to manage".

Implementation Responsibilities:

Cost Allocation - The estimated first cost and annual charges for Plan 7, based on February 1980 prices, are summarized in Table 4. Cost considerations are identical to Plans 3 and 4.

TABLE 4
PLAN 7
SUMMARY OF FIRST COST AND ANNUAL CHARGES
(SHIPYARD RIVER - UPLAND DISPOSAL)

ITEM	COST	
<u>FIRST COSTS</u>		
<u>Federal</u>		
Dredging	\$3,456,000	
Navigation Aids	<u>2,000</u>	
Subtotal	\$3,458,000	
<u>Non-Federal</u>		
Levees and Spillways	\$ 891,000	
Lands	583,000	
Berthing Areas	<u>339,000</u>	
Subtotal	\$1,813,000	
<u>Total First Costs</u>	\$5,271,000	
	<u>Proposed</u>	<u>Existing</u>
	<u>Cost Allocation</u>	<u>Cost Allocation</u>
<u>SUMMARY OF ADJUSTED FIRST COST</u>		
Federal	\$3,194,000 (1)	\$3,458,000
Non-Federal	<u>2,077,000 (2)</u>	<u>1,813,000</u>
Total Adjusted First Cost	\$5,271,000	\$5,271,000
<u>ANNUAL CHARGES</u>		
<u>Federal</u>		
First Cost	\$3,194,000	\$3,458,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Federal Investment	\$3,194,000	\$3,458,000
Interest of Investment @ 7-1/8%	\$ 227,000	\$ 246,000
Amortization @ .2357%	7,000	8,000
Maintenance	<u>737,000</u>	<u>737,000</u>
Total Federal Annual Charge	\$ 971,000	\$ 991,000
<u>Non-Federal</u>		
First Cost	\$2,077,000	\$1,813,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Non-Federal Investment	\$2,077,000	\$1,813,000
Interest on Investment @ 7-1/8%	\$ 148,000	\$ 129,000
Amortization @ .2357%	5,000	4,000
Maintenance	<u>131,000</u>	<u>131,000</u>
Total Non-Federal Annual Charges	\$ 284,000	\$ 264,000
<u>SUMMARY OF ANNUAL CHARGES</u>		
Federal	\$ 971,000	\$ 991,000
Non-Federal	<u>284,000</u>	<u>264,000</u>
Total Annual Charge	\$1,255,000	\$1,255,000

(1) \$3,458,000 - (\$5,271,000 x .05)
(2) \$1,813,000 + (\$5,271,000 x .05)

Federal Responsibilities - The Federal responsibilities are identical to Plan 3. The presently estimated share of the total first cost for Plan 7 is \$3,194,000, or 61% of the total estimated first cost. The estimated Federal annual charge is \$971,000, of which \$737,000 is for maintenance dredging.

Non-Federal Responsibilities - The non-Federal responsibilities are also the same as Plan 3. The presently estimated share of the total first cost for Plan 7 is \$2,077,000. The estimated annual charge is estimated at \$284,000, of which \$131,000 is for annual maintenance dredging.

PLAN 8

Plan Description. Plan 8 also consists of deepening the existing Shipyard River project from 30 to 38 feet. The channel and basin enlargements contained in Plan 7 are also included in Plan 8. The only difference in the two plans is the method of disposal.

Disposal of Material. The implementation of Plan 8 will require removal of the material by a special dredge pumping the dredged material into hopper barges located alongside the dredge and transporting the material to the Atlantic Ocean by barges for disposal in specified areas.

Impact Assessment. Impacts of Plan 8, which would occur during dredging, are the same as those described for Plan 7. Unlike Plan 7 however, Plan 8 would require no upland disposal sites. The material from Shipyard River, although not as clean as material from other parts of the harbor, has been shown by bioassays, bioaccumulation studies, chemical analyses to be suitable for ocean disposal without acute or long-term effects (See page 79 of this report).

Implementation Responsibilities.

Cost Allocation. The estimated first cost and annual charge for Plan 8, based on February 1980 prices, are summarized in Table 5. The considerations are the same as Plan 3.

Federal Responsibilities. The Federal responsibilities are identical to Plan 3. The presently estimated Federal share of the total first cost is \$5,504,000 or 88%. The estimated Federal annual charge is \$1,400,000 of which \$995,000 is for annual maintenance.

Non-Federal Responsibilities. The non-Federal responsibilities are the same as Plan 4. The presently estimated non-Federal share of the total first cost is \$720,000, while the estimated annual charge is \$53,000.

PUBLIC VIEWS

The draft report was reviewed by various Federal, State and local agencies, and interested organizations and individuals. The State Ports Authority, EPA, the Federal and Wildlife Service and the S.C. Wildlife & Marine Resources all commented favorably to ocean dumping in lieu of up-land disposal. The Governor of South Carolina and the State Ports Authority objected to the proposed item of local cooperation which requires the State of South Carolina to contribute in cash 5% of the total project cost. At a public meeting held 5 February 1980, the results and recommendation were announced. Those in attendance spoke in favor of the project.

COMPARISON OF DETAIL PLANS

The current authorized project depth of 35 feet (mlw) for Charleston Harbor restricts the safe draft of vessels over the waterway to 31 feet as four feet of clearance should be provided between the vessel keel and channel bottom for maneuverability and safety. Therefore, vessels with drafts of 31 feet and greater must utilize tidal advantage and/or light loading to safely transit the waterway. The authorized Shipyard River

TABLE 5
PLAN 8
SUMMARY OF FIRST COST AND ANNUAL CHARGES
(SHIPYARD RIVER - OCEAN DISPOSAL)

ITEM	COST	
<u>FIRST COSTS</u>		
<u>Federal</u>		
Dredging		\$5,813,000
Navigation Aids		<u>2,000</u>
Subtotal		\$5,815,000
<u>Non-Federal</u>		
Berthing Areas		\$ 409,000
<u>Total First Costs</u>		\$6,224,000
	<u>Proposed Cost Allocation</u>	<u>Existing Cost Allocation</u>
<u>SUMMARY OF ADJUSTED FIRST COST</u>		
Federal	\$5,504,000 (1)	\$5,815,000
Non-Federal	<u>702,000 (2)</u>	<u>409,000</u>
Total Adjusted First Cost	\$6,224,000	\$6,224,000
<u>ANNUAL CHARGES</u>		
<u>Federal</u>		
First Cost	\$5,504,000	\$5,815,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Federal Investment	\$5,504,000	\$5,815,000
Interest @ 9-1/8%	\$ 392,000	\$ 414,000
Amortization @ .2357%	<u>13,000</u>	<u>14,000</u>
Maintenance	<u>995,000</u>	<u>995,000</u>
Total Federal	\$1,400,000	\$1,423,000
<u>Non-Federal</u>		
First Cost	\$ 720,000	\$ 409,000
Interest During Construction	<u>None</u>	<u>None</u>
Total Non-Federal	\$ 720,000	\$ 409,000
Interest @ 7-1/8%	\$ 51,000	\$ 29,000
Amortization @ .2357%	<u>2,000</u>	<u>1,000</u>
Total Non-Federal	\$ 53,000	\$ 30,000
<u>SUMMARY OF ANNUAL CHARGES</u>		
Federal	\$1,400,000	\$1,423,000
Non-Federal	<u>53,000</u>	<u>30,000</u>
Total Annual Charge	\$1,453,000	\$1,453,000

(1) \$5,815,000 - (\$6,224,000 x .05)

(2) \$409,000 ÷ (\$6,224,000 x .05)

project provides for a channel depth of 30 feet (mlw). Vessels with drafts of 26 feet or less can safely navigate Shipyard River at all times. Therefore, proposed modifications to the waterways and associated benefits are predicated on that portion of the future vessel fleet expected to utilize the waterway during the 50-year life of the modification and whose loaded drafts penetrate the required four-foot clearance between the vessel keel and existing channel bottom.

PLAN COMPARISON

Of the possible solutions considered, modification (deepening and widening) of the Charleston Harbor and Shipyard River channels proved to be the most responsive means of the port to meet future demands of vessels and shippers. Investigated alternatives were eliminated by physical or monetary constraints. Detailed analysis of all considered plans indicated channel deepening, with associated anchorage and turning basins of commensurate depth, to 40 feet and 38 feet for the existing Charleston Harbor and Shipyard River channels, respectively, to be the most viable solution based on the needs of existing and prospective vessel traffic.

There are two viable means of disposing of the dredged material from the channel enlargement discussed above: upland disposal of inner harbor material on Daniel Island by pipeline dredge and ocean disposal by special dredge and hopper barge. (Ocean disposal of entrance material by hopper dredge is recommended for both harbor plans, 3 and 4.) Use of the upland disposal areas would temporarily remove valuable farmland from production and would severely alter woodlands and other wildlife habitat for periods ranging from two or three years (open areas) to 30 or 40 years (mature hardwoods). Because of this detrimental effect on upland areas and the fact that the bioassay and benthic studies

predict no significant adverse effects from ocean dumping, it appears that ocean disposal would be the preferred method of disposal, dependent on availability of the required special equipment at the time the project is constructed. A comparison of the combination of the total annual charges for the 40-foot project in Cooper River and a 38-foot project in Shipyard River is shown on Table 6. This comparison shows that ocean disposal is the most economical means of disposing of the dredged material; however, there are no past records on which to base the cost estimate for ocean disposal, therefore, it would not be as reliable as the estimates for pipeline dredging. Until ocean disposal becomes competitive between the various dredging companies, the cost may be higher than estimated.

TABLE 6
Comparison of Plans

	Annual Charges		Total
	Cooper River (40')	Shipyard River (38')	
Daniel Island	\$ 6,702,000	\$ 1,255,000	\$ 7,957,000
Ocean Disposal	\$ 6,182,000	\$ 1,453,000	\$ 7,655,000

The System of Accounts (S of A), shown as Tables 7 and 8, are a display requirement of the Water Resource Council, "Principles and Standards" and are an integral part of the planning process. The System of Accounts displays all significant beneficial and adverse contributions of each alternative carried through the final planning stage and provides a useful tool to assist in the selection process. The S of A also satisfies the display requirements of Section 122,

Public Law 91-611, River and Harbor and Flood Control Act of 1970. Tables 7 and 8 display the breadth and detail of the assessment and evaluation of all alternative plans. Tables 9 and 10 summarize Tables 7 and 8 and present the crucial planning consideration underlying each alternative. Tables 9 and 10 are presented later in this report on pages 48 and 50.

RATIONALE FOR DESIGNATION OF NED PLAN

The Principles and Standards require the designation of National Economic Development (NED) Plan. This plan is described as the plan which best addresses the planning objectives in a way which maximizes net economic benefits. Consideration was given to deepening Charleston Harbor to 38, 40 and 42 feet. The plan which provided the greatest amount of excess benefits over cost consists of deepening the entrance channel to 42 feet, the channels and basins in Cooper River and Town Creek to 40 feet and the channels and basin in Shipyard River to 38 feet. Plans 3 and 7, which utilize ocean dumping, are shown to be the most economic means of modifying and maintaining the navigation project; therefore, this method is designated as the NED Plan.

RATIONAL FOR DESIGNATION OF EQ PLAN

The Principles and Standards also require the designation of an Environmental Quality Plan (EQ Plan). This plan is described as the plan which will make the most significant contribution to preserving, maintaining, restoring, or enhancing cultural and natural resources. As is the usual case with improvement to existing deep draft navigation projects, there was no plan which was identified that would result in a net improvement to the environment of the project area. Accordingly, no environmental quality (EQ) plan was designated for Phase I studies. The Plans 3 and 7, which utilize ocean disposal areas rather than upland disposal sites, are the environmentally oriented NED plans (i.e., the plans with the fewest environmental impacts).

CHARLESTON HARBOR

40

TABLE 7 - SYSTEM OF ACCOUNTS

ACCOUNTS AND EFFECTS	PLAN 1 NO ACTION				PLAN 2 NONSTRUCTURAL				PLAN 3 40 FT. PROJECT UPLAND DISPOSAL				PLAN 4 40 FT. PROJECT OCEAN DISPOSAL			
	LOCATION OF IMPACT				LOCATION OF IMPACT				LOCATION OF IMPACT				LOCATION OF IMPACT			
	WITHIN THE STUDY AREA				WITHIN THE STUDY AREA				WITHIN THE STUDY AREA				WITHIN THE STUDY AREA			
	ACTIVITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTIVITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTIVITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTIVITY	EXCLUSIVITY	UNCERTAINTY	TIMING
3. Social Well Being																
a. Beneficial Impacts																
Social Well Being	Small increase in employment as long as port is competitive; greater than 2, less than 3.	Negligible.	2	5	No positive results.	9	2	5	Substantial increase in employment will occur throughout State or 2. Same as greater than 1 & 2, same as 4.	9	2	5	Substantial increase in employment. Greater than 1 or 2, same as 3.	9	2	5
b. Adverse Impacts																
Cultural Resources	Cultural resources impacted by non-sell farming practices and by North Clark Supremacy on Baidal Island.		1	6	Same as No Action Plan.	10	1	6	Major sites can be avoided. Scatter-ad effects in project area would be collected and studied.	9	1	6	No sufficient impacts.	9	2	5
4. Other Economic Effects																
a. Regional Impacts																
(1) Tax Revenue	No positive effects.				No positive effects.				Increase in taxes due to additional and higher paying jobs. Greater than 1 or 2, same as 4.	9	2	6	Increase in taxes due to additional and higher paying jobs. Greater than 1 or 2, same as 3.	9	2	6
(2) Property Values	No positive effects.				No positive effects.				Increase in property value, greater than 1 or 2, same as 4.	9	2	6	Increase in property value, greater than 1 or 2, same as 4.	9	2	6
(3) Public Facilities	No positive effects.				No positive effects.				No positive effects.	9	2	6	No positive effects.	9	2	6
(4) Public Service	No positive effects.				No positive effects.				No positive effects.	9	2	6	No positive effects.	9	2	6
(5) Regional Growth	No positive effects.				No positive effects.				Encourage regional growth same as 3, greater than 1 or 2.	9	2	6	Encourage regional growth same as 3, greater than 1 or 2.	9	2	6
(6) Employment/Labor Force	No positive effects.				No positive effects.				Increase employment/labor force more than 1 or 2, same as 4.	9	2	6	Increase employment/labor force more than 1 or 2, same as 3.	9	2	6
(7) Business and Ind. Activity	No positive effects.				No positive effects.				Increase in business and industrial activity more than 1 or 2, same as 4.	9	2	6	Increase in business and industrial activity more than 1 or 2, same as 4.	9	2	6
b. Adverse Effects																
(1) Tax Revenue	No adverse effects.				No adverse effects.				No adverse effects.	9	2	6	No adverse effects.	9	2	6
(2) Property Values	No adverse effects.				No adverse effects.				No adverse effects.	9	2	6	No adverse effects.	9	2	6
(3) Public Facilities	No adverse effects.				No adverse effects.				No adverse effects.	9	2	6	No adverse effects.	9	2	6
(4) Public Service	No adverse effects.				No adverse effects.				No adverse effects.	9	2	6	No adverse effects.	9	2	6

TABLE 7 - SYSTEM OF ACCOUNTS

ACCOUNTS AND EFFECTS		PLAN 1 NO ACTION				PLAN 2 CONSTRUCTION				PLAN 3 40 FT. PROJECT UPLAND DISPOSAL				PLAN 4 40 FT. PROJECT OCEAN DISPOSAL			
		LOCATION OF IMPACT				LOCATION OF IMPACT				LOCATION OF IMPACT				LOCATION OF IMPACT			
		WITHIN THE STUDY AREA OF THE NATION				WITHIN THE STUDY AREA OF THE NATION				WITHIN THE STUDY AREA OF THE NATION				WITHIN THE STUDY AREA OF THE NATION			
		ACTUALITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTUALITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTUALITY	EXCLUSIVITY	UNCERTAINTY	TIMING	ACTUALITY	EXCLUSIVITY	UNCERTAINTY	TIMING
4.b. (Continued)																	
* (5) Regional Growth		No adverse effects.				No adverse effects.				No adverse effects.				No adverse effects.			
* (6) Employment/Labor Force		No adverse effects.				No adverse effects.				No adverse effects.				No adverse effects.			
* (7) Business and Ind. Activity		No adverse effects.				No adverse effects.				No adverse effects.				No adverse effects.			
* (8) Displacement of Farmer		Penalties in corridor of Mark Clark Expressway will be displaced.				Same as No Action Plan.				Use of prime farm land (477 acres) will be forgone during construction and for about 2-3 years afterward.				Same as No Action Plan			
Index of Uncertainty:		1. Impact is expected to occur prior to or during implementation of the plan.				4. The uncertainty associated with the impact is 50% or more.				7. Overlapping entry; fully monetized in MED account.				9. Impact will occur with implementation.			
		2. Impact is expected within 15 years following plan implementation.				5. The uncertainty is between 10 and 50%.				8. Overlapping entry; not fully monetized in MED account.				10. Impact will occur only when specific additional actions are carried out during implementation.			
		3. Impact is expected in a longer time frame (15 or more years following implementation).												11. Impact will not occur because necessary additional actions are lacking.			
		* (9) Business and Ind. Activity															
		* (10) Displacement of Farmer															

TABLE 8 - SYSTEM OF ACCOUNTS

ACCOUNTS AND EFFECTS	PLAN 5 NO ACTION			PLAN 6 NONSTRUCTURAL			PLAN 7 38 FT PROJECT UPLAND DISPOSAL			PLAN 8 38 FT PROJECT OCEAN DISPOSAL		
	LOCATION OF IMPACT			LOCATION OF IMPACT			LOCATION OF IMPACT			LOCATION OF IMPACT		
	WITHIN THE STUDY AREA	WITHIN THE REST OF THE NATION	TIMING	WITHIN THE STUDY AREA	WITHIN THE REST OF THE NATION	TIMING	WITHIN THE STUDY AREA	WITHIN THE REST OF THE NATION	TIMING	WITHIN THE STUDY AREA	WITHIN THE REST OF THE NATION	TIMING
1. National Economic Development												
a. Beneficial Impacts												
(1) Transportation												
(2) Savings												
(3) Recreation-Annual												
(4) Total Net Benefit-Annual												
b. Adverse Impacts												
(1) Project First Costs												
(2) Annual Costs												
(3) Annual Net Costs												
(4) Total Annual Costs												
c. Net NED Benefits												
2. Environmental Quality												
a. Environmental Quality Enhanced												
(1) Exchange												
(2) Non-Exchange												
(3) Natural Resources												
(4) Water Quality												
b. Environmental Quality Degraded												
(1) Exchange												
(2) Non-Exchange												
(3) Natural Resources												
(4) Water Quality												

[illegible]

TABLE 8 - SYSTEM OF ACCOUNTS

ACCOUNTS AND EFFECTS		PLAN 6 NO ACTION				PLAN 7 NONSTRUCTURAL				PLAN 8 30 FT. PROJECT UPLAND DISPOSAL				PLAN 9 30 FT. PROJECT OCEAN DISPOSAL			
		LOCATION OF IMPACT		TIMING	ACTUALITY	LOCATION OF IMPACT		TIMING	ACTUALITY	LOCATION OF IMPACT		TIMING	ACTUALITY	LOCATION OF IMPACT		TIMING	ACTUALITY
		WITHIN THE STUDY AREA	WITHIN THE BEST OF THE NATION			WITHIN THE STUDY AREA	WITHIN THE BEST OF THE NATION			WITHIN THE STUDY AREA	WITHIN THE BEST OF THE NATION			WITHIN THE STUDY AREA	WITHIN THE BEST OF THE NATION		
Index of footnotes:	(6) Employment/Labor Force	No adverse effects.				No adverse effects.				No adverse effects.				No adverse effects.			
	(7) Business and Ind. Activity	No adverse effects.				No adverse effects.				No adverse effects.				No adverse effects.			
	(8) Displacement of Farms	Farmlands in corridor at Mark Clark Expressway will be displaced.		1 6 8 10		Same as No Action Plan.				Use of prime farmland will be forgone during construction and for about 2-3 years afterward.		1 5 8 9		Same as No Action Plan.		2 5	9
Index of footnotes:																	
		<p>UNCERTAINTY</p> <p>4. The uncertainty associated with the impact is 50% or more.</p> <p>5. The uncertainty is between 10 and 50%.</p> <p>6. The uncertainty is less than 10%.</p>															
		<p>EXCLUSIVITY</p> <p>7. Overlapping entry; fully monetized in RFD account.</p> <p>8. Overlapping entry; not fully monetized in RFD account.</p>															
		<p>ACTUALITY</p> <p>9. Impact will occur with implementation.</p> <p>10. Impact will occur only when specific additional actions are carried out during implementation.</p> <p>11. Impact will not occur because necessary additional actions are lacking.</p>															

RATIONALE FOR DESIGNATION OF SELECTED PLAN

Plan selection is the designation of the most desirable alternative based on results of this detailed study. This selection is also influenced by the public response to the various plans of improvement. As discussed in the preceding paragraphs, the plans providing channel depths of 40 feet in Cooper River and 38 feet in Shipyard River, using ocean disposal, are the NED and environmentally oriented NED plans. However, until all problems associated with ocean dumping are resolved, the final selection of the method of channel construction will not be made.

Conclusions

The economic development of South Carolina has grown at a steady rate during the last decade. Much of the economic growth and future development is directly dependent on the Port of Charleston. Despite the economic improvement of the past decade, the state remains near the bottom, 48th, in per capita income. If the much needed favorable economic growth is to continue, the Port of Charleston must remain as a viable and safe harbor adequately serving the future needs imposed by shippers and vessels.

Various solutions to the problems and needs of continued harbor development were analyzed. Based on the results of this analysis and demonstrated interest by private industry and local authorities, it is concluded that the most feasible plan for satisfying future harbor needs consists of deepening the existing Charleston Harbor and Shipyard River channels. Minor channel widening and improved turning basins of commensurate depth with the channels will be provided.

Social and economic benefits of implementation of the selected plan include increased employment and property values, continued diversification of the state's economy, transportation savings, and expansion of port activity and related industry.

Based on the economic and engineering studies made during this investigation, the selected plan of improvement for navigation is economically justified. The estimated investment and annual charges are \$57,178,000 and \$7,957,000 respectively for deepening the existing Charleston Harbor project to 40 feet and the existing Shipyard River project to 38 feet. These costs are based on upland disposal on Daniel Island. Annual benefits are estimated at \$16,784,000 or a benefit to cost ratio of 2.11.

Construction would be by the United States after congressional authorization and funding and after receipt of the non-Federal share of the cost. Following construction, the Federal Government would maintain project depths in the improved channels. Non-Federal interests would maintain all levees and spillways of project disposal areas and commensurate depths at dock facilities.

The plans are acceptable to local interests. Assurances of non-Federal participation in the recommended navigation improvements will be furnished in the final report.

A profile of the social, environmental and ecological implications of implementation of the selected plan and considered alternatives during project formulation are shown in Tables 9 and 10 in compliance with the directive of Congress contained in Section 122 of the River and Harbor and Flood Control Act of 1970 (P. L. 91-611).

The discharge of dredged material has been evaluated according to Section 404 of the Clean Water Act; the detailed evaluation and findings are contained in pages 59-78 of this report.

TABLE-9
SUMMARY SYSTEM OF ACCOUNTS
CHARLESTON HARBOR

A. PLAN DESCRIPTION	NO ACTION	40 FT. PROJECT UPLAND DISPOSAL OF UNDER HARBOR WATER U. & P.	40 FT. PROJECT OCEAN DISPOSAL OF ALL MATERIAL
<p>B. SIGNIFICANT IMPACTS</p> <p>1. Environmental</p> <p>a. Aesthetic Value</p> <p>b. Natural Resources</p> <p>c. Natural Resources</p> <p>d. Water Quality</p> <p>e. Air Quality</p> <p>f. Noise</p> <p>2. Social</p> <p>a. Community Cohesion</p> <p>b. Community Growth</p> <p>c. Displacement of People and Community Disruptions</p> <p>3. Other Economic Effects</p> <p>a. Tax Revenues</p> <p>b. Property Values</p> <p>c. Public Facilities</p> <p>d. Public Service</p> <p>e. Regional Growth</p> <p>f. Employment/Labor Force</p> <p>g. Business and Ind. Activity</p> <p>h. Displacement of Yards</p>	<p>Expressway will change "isolated" appearance of Daniel Island.</p> <p>Facilities in expressway corridor lost.</p> <p>Wildlife in expressway corridor reduced and/or changed.</p> <p>Increase in point source pollutants; increase in area sources.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Charleston area will continue to grow.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No change.</p>	<p>Disposal will alter visual appearance of Daniel Island (1,000 acres).</p> <p>Use of crop and pastureland forgoes (2-4 years).</p> <p>Wildlife habitats in disposal area reduced and/or altered.</p> <p>Temporary increase in turbidity.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Greater growth will occur than no action plan.</p> <p>No significant impact.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>Use of crop and pastureland forgoes (2-4 years).</p> <p>Beneficial long term effect.</p>	<p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Temporary increase in turbidity.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Same as Plan 1.</p> <p>No significant impact.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>No significant impact.</p> <p>No significant impact.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>Beneficial long term effect.</p> <p>Same as the Action Plan.</p>
<p>C. PLAN EVALUATION</p> <p>1. Contribution to Planning Objectives</p> <p>a. Improvement to Navigation</p> <p>b. Minimize Adverse Impacts Due to Breeding and Disposal of Material</p> <p>2. Relationship to Other National Accounts</p> <p>a. NEP</p> <p>(1) Beneficial (Annual Benefiter)</p> <p>(a) Transportation Savings</p> <p>(b) Recreation</p> <p>(c) Total</p>		<p>Beneficial long term effect.</p> <p>Eliminated upland disposal area and ocean dumping license impacts on aquatic environment. Cultural resources, wildlife and water quality adequately handled.</p>	<p>Beneficial long term effect.</p> <p>Least environmental impact of plans which use navigation and ocean disposal facilities. No additional upland disposal sites needed.</p>
		<p>\$12,153,000 NONE \$12,153,000</p>	<p>\$12,153,000 NONE \$12,153,000</p>

TABLE - 9

B - Beneficial Impact
 A - Adverse Impact
 N - Neutral Impact
 T - Temporary
 L - Long Term
 * - Significant Impact

TABLE - 10

[illegible]

TABLE - IO
SUMMARY SYSTEM OF ACCOUNTS
SHIPYARD RIVER

C.2.a. (CONTINUED)	NO ACTION	36 FT. PROJECT OTLAND DISPOSAL	36 FT. PROJECT OCEAN DISPOSAL
<p>(2) Adverse (Annual Charges)</p> <p>(a) Interest and Amortization</p> <p>(b) Operation and Maintenance</p> <p>(c) Total</p> <p>(3) B/C Ratio</p> <p>b. BQ</p> <p>(1) Benefits</p> <p>*(2) Water Quality</p> <p>(3) Fish and Wildlife Habitat</p> <p>c. SUB</p> <p>d. BD</p>	<p>No significant change. Existing 30-foot channel would continue to be maintained and benches in the channel would be disrupted annually.</p> <p>No significant change.</p> <p>Habitat in estuary right-of-way reduced and/or modified.</p> <p>Cultural resources impacted by normal farming practices and by estuary on Daniel Island. Recovery of data by ADC.</p> <p>No significant impact.</p> <p>Unacceptable. Does not meet local needs.</p> <p>Navigation needs only partially met.</p> <p>All stages to achieve plan are included.</p> <p>Bank last of final plans.</p> <p>No benefits.</p> <p>Does not apply.</p> <p>Stable if properly maintained.</p> <p>None</p>	<p>Regularly maintained channel bottom and associated benches would continue to be disrupted annually. No significant impact of upland or ocean site.</p> <p>No significant change. More dredging would cause turbidity over longer period.</p> <p>Habitat reduced. Open areas and crop lands for short periods. (Wooded areas for 40 years.)</p> <p>Recovery of data from minor sites that are now being disturbed and have no protection is a positive contribution to regional archeology.</p> <p>Minimal beneficial impact.</p> <p>High. Above 1, less than 3, because of disposal area cost and availability.</p> <p>Navigation needs are met.</p> <p>All stages to achieve plan are included.</p> <p>Bank second of final plans.</p> <p>Benefits accrue primarily within study area.</p> <p>Can be recovered by not maintaining.</p> <p>Stable if properly maintained.</p> <p>3.69</p>	<p>Same as upland disposal option.</p> <p>Same as upland disposal option.</p> <p>Same as action plan.</p> <p>Same as no action plan.</p> <p>Minimal beneficial impact.</p> <p>High. Above both 1 and 2.</p> <p>Navigation needs are met.</p> <p>All stages to achieve plan are included.</p> <p>Bank first of final plans.</p> <p>Benefits accrue primarily within study area.</p> <p>Can be recovered by not maintaining.</p> <p>Stable if properly maintained.</p> <p>3.19</p>
		<p>\$ 387,000</p> <p>869,000</p> <p><u>31,255,000</u></p> <p>3.69</p>	<p>\$ 456,000</p> <p>995,000</p> <p><u>31,537,000</u></p> <p>3.19</p>
		<p>\$1,194,000</p> <p>2,027,000</p> <p><u>31,311,000</u></p> <p>3.69</p>	<p>\$1,394,000</p> <p>2,720,000</p> <p><u>34,234,000</u></p> <p>3.19</p>

NOTES: B - Beneficial Impact
A - Adverse Impact
B - Minimal Impact
T - Temporary
L - Long Term
C - Significant impacts specified in Section 122 of PL 91-611.

Studies show that ocean disposal is the most economical and environmentally satisfactory means of disposing of dredged material from the proposed modifications to Charleston Harbor. There is some concern, however, that sufficient equipment may not be available in time for the initial construction of the project, therefore, for the purpose of project formulation, cost estimates are based on the use of upland disposal areas for placement of dredged material by pipeline dredge from the inner harbor.

Recommended Plan

The recommended plan for Charleston Harbor provides for a channel 42 feet in the entrance and jetty channel and 40 feet in the inland channels and basins except Shipyard River, where a channel depth of 38 feet would be provided. In addition to channel deepening, the recommended plan provides for:

(a) Modification of the turning basin adjacent to the Columbus Street docks to provide a turning diameter of 1,200 feet.

(b) Enlargement of the existing turning basin at the head of commercial navigation (Goose Creek) to provide a 1,200-foot turning diameter.

(c) Enlargement of the anchorage basin by extending the south side of the basin 1,400 feet.

(d) Realignment of the channel centerline to provide 125 feet between existing docks, piers, etc., and the edge of the channel.

(e) Easing of the bend at the northern approach to the Cooper River Bridge.

(f) Widening of the Filbin Creek and North Charleston reaches to 500 feet.

(g) Widening of the Shipyard River connecting channel to 250 feet.

(h) Enlargement of the existing turning basins on Shipyard River to provide a 1,000-foot turning diameter.

Plate 1 shows the recommended modification to the existing project. Plates 2-5 show these modifications in more detail with the waterway being shown by various reaches.

SUPPLEMENTAL INFORMATION REPORT AND ATTACHMENTS

SUPPLEMENTAL INFORMATION REPORT AND ATTACHMENTS

Table of Contents

<u>Item</u>	<u>Page</u>
SUPPLEMENTAL INFORMATION REPORT	56
ATTACHMENT 1 - 404(b)(1) EVALUATION	58
<u>Project Description</u>	59
<u>Physical Effects</u>	66
<u>Chemical-Biological Interactive Effects</u>	69
<u>Description of Site Comparison</u>	71
<u>Review Applicable Water Quality Standards</u>	72
<u>Selection of Disposal Sites For Dredged or Fill Material</u>	72
<u>Statements As To Contamination of Fill Material If From</u>	77
<u>A Land Source</u>	
<u>Determination of Mixing Zone</u>	77
<u>Conclusions</u>	77
<u>Findings</u>	78
ATTACHMENT 2 - BIOLOGICAL STUDIES FOR POTENTIAL DISPOSAL SITES	80
ON DANIEL ISLAND	
<u>General</u>	80
<u>Environmental Setting</u>	80
<u>Future Environmental Setting Without Project</u>	88
<u>Impacts of Dredged Material Deposition on the Environ-</u>	89
<u>mental Setting</u>	
ATTACHMENT 3 - OCEAN DUMPING - EVALUATION OF IMPACTS	94
Summary and Conclusions - Entrance Channel	97
Summary and Conclusions - Inner Harbor	99
Conclusions of Benthic Studies at the Ocean Disposal Site	102
ATTACHMENT 4 - CULTURAL RESOURCES	109
ATTACHMENT 5 - OTHER LAWS, EXECUTIVE ORDERS AND DIRECTIVES	113

SUPPLEMENTAL INFORMATION REPORT

SUMMARY

In April 1976, a Final Environmental Impact Statement was filed with CEQ, coordinated with other agencies, and circulated for public review and comment, based on recommendations made in the survey report for "Deepening and Extending Channels for Navigation in Charleston Harbor, South Carolina". Since April 1976, the Charleston District has conducted Phase I studies to bridge the gap between the time of Congressional authorization based on the survey report and the initiation of detailed engineering and design studies. The Phase I study reaffirmed the appropriateness of the authorized plan in light of current conditions and criteria, and the project now proposed is the same as that discussed in the FEIS.

A variety of alternatives was examined in the early stages of planning during the survey studies. These included a lighterage system, an offshore ocean terminal, a terminal at Cummings Point, light loading at Savannah and/or Wilmington, and a pipeline system. None of the above alternatives were capable of accommodating tanker and container vessels and their associated commerce. Because these alternatives were unable to satisfy the existing and future needs of the area served by the Port of Charleston, the alternatives were not considered beyond the Stage I planning of the survey study. Given the limited scope of the Phase I authorization, the absence of viable alternatives, and the appropriateness of the authorized plan, no further consideration was given to alternatives during Phase I. Instead, efforts were concentrated on avoiding or minimizing adverse effects of the proposed plan.

Since 1976, there have been several changes in laws and regulations, particularly in those which set forth the reporting and coordination of information generated by Corps studies. The Charleston Harbor Deepening Project has been reevaluated for compliance with the more recent laws, Executive Orders and regulations. Summaries of the more pertinent findings are included as Attachments 1-5. Although these recent evaluations provide more information about the project area, they have disclosed no significant environmental impacts in addition to those included in the Final EIS and those already considered when making the decision on the proposed action. Since there are no changes in the project and no new impacts, a formal supplement to the Final EIS is not necessary. This supplemental information report is included in the Phase I feasibility report and offered to concerned agencies and the public to inform them of the lack of change and the compliance of the project with applicable laws and regulations. The report also contains consideration of the effects of disposal of dredged or fill material, including Section 404(b)(1) Guidelines, for submittal to Congress under the provisions of Section 404(r), Public Law 92-500, as amended.

ATTACHMENT 1
404(b)(1) EVALUATION

AN EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED
OR FILL MATERIAL INTO WATERS OF THE UNITED STATES;
DEEPENING OF CHARLESTON HARBOR AND SHIPYARD RIVER, SOUTH CAROLINA
PURSUANT TO SECTION 404(b) OF THE CLEAN WATER ACT

1. Project Description.

a. Channel Improvements. The recommended plan of improvement consists of the deepening of the entrance channel to Charleston Harbor from a depth of 35 feet to a depth of 42 feet and the extension of this channel from Mile -10.4 seaward to the 42-foot depth contour (Mile -11.2); deepening the existing harbor channels from a depth of 35 feet to a depth of 40 feet from the Entrance Channel (Mile 0.6) to Mile 15.7 at Goose Creek; deepening of the Shipyard River channel from 30 feet to 38 feet; enlargement of the upstream and downstream turning basins in Shipyard River to provide a 1,000-foot diameter turning area and to widen the connecting channel between the two basins to 250 feet; enlargement of the anchorage basin near the harbor mouth by deepening to a depth of 40 feet and by extending the south side by 1,400 feet; enlargement of the turning basin at the head of the commercial channel at Goose Creek; dredging a new turning-basin adjacent to the Columbus Street docks; widening the North Charleston and Filbin Creek reaches to 500 feet; easing the bend at the intersection of the channel and Wando River; and the relocating of channels near terminals to provide 125-foot clearance between piers and the edge of the channel.

b. Disposal of Dredged Material.

(1) General. As a result of Federal legislation and Executive Orders, the disposal of dredged material into waters of the United States (including adjacent wetlands) is prohibited, except where no practicable alternatives having lesser impact exist and where the Federal activity is necessary. The existing diked disposal areas presently used for

maintenance of the inner portion of Charleston Harbor do not have sufficient capacity for the material which would be dredged during the enlargement of the channel and for the additional yardage generated by increased annual maintenance. Two methods for disposal of the additional material have been closely examined: ocean disposal and disposal in diked upland sites. The former method, although attractive from environmental and economic viewpoints, can not be relied upon at the present time because the special dredge needed to pump the dredged material and the special hopper barges needed for transportation to ocean sites are not available commercially or from Government plant. Since upland disposal of inner harbor material is the only acceptable method which can now be positively stated as capable of being implemented, this is the method discussed in the Final EIS and in the 404(b)(1) evaluation which follows. This evaluation also provides a "worst case" 404(b) evaluation among the acceptable upland alternatives.

(2) Acquisition of Disposal Areas. The local sponsor for the project is required to provide suitable disposal areas, but does not acquire title to or easements on specific tracts of land until the later stages of planning when the sponsor has been assured by Congress that a project will actually be built. The S. C. State Ports Authority, the local sponsor for the Charleston Harbor Deepening Project, has stated that, if needed at the time of construction (1985 - 1986), it would acquire the approximately 1,000 acres of disposal area on Daniel Island. Based on current environmental regulations, on existing and projected land use and on reasonable pumping distances, five tracts of land on Daniel Island totalling approximately 2,500 acres have been identified as possible disposal areas. All the areas would not be used, but an evaluation of all five covers the range of possible future upland areas and includes the worst possible case. If, at some later date, ocean disposal of inner harbor material becomes feasible, this method will probably be employed instead of upland disposal. Evaluations and public disclosure will be updated in accordance with the laws and regulations applicable at that time.

(3) Jurisdiction Under Section 404. The five disposal areas were grouped under one 404(b)(1) evaluation because of several similarities: (a) they are all on Daniel Island; (b) they would be diked on all sides; and, (c) with the exception of small, incidentally included low areas in Plot D, they are all uplands. Disposal of dredged material on the upland sites does not fall under the jurisdiction of Section 404 or require a 404(b) evaluation. Therefore, the only actions which are included in this evaluation are the release of suspended fine materials into waters of the United States through the diked area spillways during the dewatering operations, and the filling of unimportant (see 2.a and 40 CFR 230.4-1) wetlands which can not be avoided in the construction of dikes.

(4) Description of the Proposed Discharge of Dredged or Fill Materials.

(a) General characteristics of material. The top layer of material dredged during the deepening of the harbor would be the recently settled silts, clays, sands and shell that are usually removed during annual maintenance. The materials dredged annually from Lower Charleston Harbor, Shipyard River and Upper Charleston Harbor are predominantly silts and clays. Maintenance of the Anchorage Basin, Shem Creek and Cove Inlet also removes silts and clays, but some sand is included. The material removed in deepening beyond normal maintenance depths to 40 feet would be silts, silty sands and clays, including Cooper marl from the upper reaches of the Cooper River.

(b) Quantities of material proposed for disposal. An estimated 14,982,000 cubic yards of material would be removed from the inner harbor during construction of the deeper harbor. Thereafter, an average of 1,096,000 cubic yards of material would be removed annually to maintain the deeper project. This additional maintenance material would be deposited in existing disposal areas now used for O&M of the 35-foot project. A 404(b) evaluation of disposal

in Charleston Harbor's existing diked areas has been prepared for the O&M of Charleston Harbor, and this evaluation will be revised (1985 or 1986) to reflect the additional annual yardage. It should be noted that only a very small portion of the material dredged will reenter waters of the United States. The quantities released through the spillways into waters of the United States can only be grossly estimated to be a small fraction of the material placed behind the dikes. (See also 6.e(7)).

(c) Source of material. The material placed in the diked disposal areas is dredged from the areas marked on Plates 1-5.

(5) Description of the Proposed Disposal Sites for Dredged or Fill Materials.

(a) Location. Diked areas and points of discharge from these areas into "waters of the United States" are shown in Figure 2. A brief description of each diked disposal area follows, although, with the exception of low areas in Plot D, the discharge into the diked areas does not require a 404(b)(1) evaluation.

Plot A - Plot A is a 309-acre site immediately west of the juncture of Ralston Creek and the Wando River. Sixty-three percent of Plot A is prime farmland. The remaining acreage within Plot A is bottomland hardwoods with a few pines scattered throughout.

Plot B - Plot B is a 841-acre site located just north of Plot A and south of Beresford's Creek. Fifty-six percent of Plot B is made up of pastureland. Fifteen percent is prime cropland. Approximately 204 acres or twenty-four percent of Plot B is bottomland hardwoods and 37 acres of five percent is composed of pine woods. Flora composition is similar to that of Plot A.

Plot C - Plot C is a 228-acre site situated northwest of Beresford's Creek and just northeast of Thomas Island. The entire site is in woodland. More than fifty percent of the site is in pine woodland. Bottomland hardwoods comprise about one-half of this plot.

Plot D - Plot D is a 523-acre site lying approximately midway between the Wando and Cooper Rivers and south of Plot A. Seventy-eight percent or 407 acres of Plot D is cropland. Eighteen percent or 96 acres of this plot is covered with hardwoods. The remaining 20 acres of this 523-acre plot is composed of a drainage canal and high salt marsh which is associated with this canal. The canal runs approximately 5,000 feet before connecting to the Wando River. This canal is flooded only on the spring tide. Vegetation includes Juncus roemerianus, short form Spartina alterniflora, and, in brackish areas, Typha (spp). Limited fishery habitat is provided during the spring tide in the drainage canal.

Plot E - Plot E is a 542-acre site lying just off the southern point of Daniel Island and is bound on the west by the Cooper River. Plot E is a former disposal area. Eighty-eight percent of this plot is now productive cropland where tomatoes, cucumbers and soybeans are grown in quantities equal to yields of nearby prime farmlands. The remaining twelve percent is made up of the old original dredge disposal dike and wooded field corners.

(b) Type of disposal sites. All areas on Daniel Island would be diked. See 1.b(5)(a) above for description. The areas outside the dikes, i.e. "the waters of the United States" receiving water and suspended sediments from the spillways, are described below:

Disposal Area	Spillways	Waters of the U. S. Receiving Discharge and Direction of Drainage
Plot A	A, B, C	Three (3) spillways (A, B, C on attached map) would empty into purposely excavated drainage ditch 3,500 feet long. The ditch would cross upland except for approximately 150 feet of <u>S. alterniflora</u> salt marsh bordering the Wando River into which the ditch would empty. There would be tidal exchange between drainage ditch and Wando River.
Plot A	D, E	Two (2) spillways (D, E on attached map) would empty into ditches approximately 500 feet long. Half this distance would be through brackish marsh made up of dominant plants of <u>S. alterniflora</u> and <u>Typha sp.</u> The ditches would be approximately 2,000 feet apart and would empty into an unnamed tributary whose waters pass through Beresford and Clouter Creeks before running into the Cooper River. There would be a tidal exchange between the drainage ditches and the unnamed tributary of Beresford's Creek.
Plot B	A, B, C, D	Four (4) spillways (A, B, C, D on attached map) would empty into purposely excavated 2,200-foot long drainage ditch which is upland except for approximately 200 feet of ditch through <u>S. alterniflora</u> marsh associated with Ralston Creek. There would be tidal exchange between drainage ditch and Ralston Creek.
Plot C	A, B, C, D, E	Five (5) spillways (A, B, C, D, E on attached map) would empty into a purposely excavated drainage ditch approximately 3,500 feet long which is upland except for 250 feet which would run through <u>S. alterniflora</u> and <u>Typha sp.</u> brackish marsh. There would be tidal exchange between drainage ditches and Ralston Creek.

Disposal Area	Spillways	Waters of the U. S. Receiving Discharge and Direction of Drainage
Plot D	A, B, C, D, E, F	Six (6) spillways (A, B, C, D, E, F on attached map) would empty into a purposely excavated ditch approximately 5,000 feet long which would open into an existing canal which runs approximately 1,300 feet into the Wando River. There would be tidal exchange between Wando River, an existing drainage canal, and the proposed drainage ditch.
Plot D	G, H	Two (2) spillways (G, H on attached map) would empty into a purposely excavated ditch approximately 4,000 feet long which would open into an unnamed tributary of the Cooper River. Approximately 25 feet of ditch would be through <u>S. alterniflora</u> salt marsh. There would be tidal exchange between unnamed tributary of Cooper River and proposed drainage ditch.
Plot E	A, B, C, D, E	Five (5) spillways (A, B, C, D, E on attached map) would empty into an existing drainage canal approximately 8,000 feet long which opens into the Wando River. The existing drainage canal is surrounded by <u>S. alterniflora</u> salt marsh at the Wando River and develops further inland into a brackish marsh with dominants of <u>S. alterniflora</u> , <u>Juncus</u> sp. and <u>Typha</u> sp. There would continue to be tidal exchange between existing drainage ditch and Wando River.

(c) Method of discharge. Hydraulic pipeline dredge into diked areas (see 1.b(1) - (4)). Water and dredge material still in suspension after settling in the above-mentioned diked areas would be released through flashboard riser-type spillways into "waters of the United States".

(d) When will disposal occur? Current estimates for construction are 1985-1987.

(e) Projected life of disposal sites. Plans are to use the new disposal areas on Daniel Island only for the material dredged during the initial deepening of the harbor (2-3 years). Maintenance material would be placed in existing disposal areas for which a 404(b)(1) evaluation has been made and coordinated with the public (See 1.b(4)(b)).

(f) Bathymetry.. Not applicable.

2. Physical Effects (40 CFR 230.4-1(a)).

a. Potential Destruction of Wetlands - Effects On (40 CFR 230.4 - 1(a)(1)(i-vi)):

(1) Food Chain Production: Twenty (20) acres of periodically flooded high salt marsh (spring tide) and tidal canal in Plot D will be replaced by silt and sand. This 20 acres of high marsh is of relatively low value as it is not regularly flooded and lacks the important functions assigned to top priority wetlands. There would be little loss in the way of primary production. Food chain production will not be affected significantly by the release of water and suspended material through spillways.

(2) General Habitat: No potential for significant effects on habitat by release through spillways. Use of Plot D for disposal of dredged material would result in the loss of 20 acres of drainage canal and associated high marsh which is periodically flooded on spring tides. This man-made canal and associated high marsh is considered of marginal value as fishery habitat for either feeding or spawning. Wading birds, ducks, and other wildlife which might be found in this area would be displaced into other marsh areas. The lower part of this canal or the part next to the Wando River is presently being used as a spillway receiver for an existing disposal site. Construction of new canals to drain the new disposal areas would create similar man-made canals.

(3) Nesting, Spawning, Rearing, and Resting Sites for Aquatic or Land Species: No impact with the exception of the 20 acres of drainage canal and associated wetlands which would be filled by sand and silt at Plot D. Filling of this wetland would not have an unimportant impact on nesting, spawning, rearing, and resting sites for aquatic or land species. Those individuals which might be currently using this area would be displaced into surrounding areas which provide a higher quality habitat.

(4) Those set aside for aquatic environment study or sanctuaries or refuges: Not applicable.

(5) Natural drainage characteristics: (See 2.a.(1)). Otherwise, not significant.

(6) Sedimentation patterns: (See 2.a.(1)). Otherwise, not significant.

(7) Salinity distribution: (See 2.a.(1)). Otherwise, not significant.

(8) Flushing characteristics: (See 2.a.(1)). Otherwise, not significant.

(9) Current patterns: Not significant (See 2.a.(1)).

(10) Wave action, erosion or storm damage protection: Not significant.

(11) Storage areas for storm and flood waters: Not applicable.

(12) Prime natural recharge areas: Not applicable.

b. Impact on Water Column (40 CFR 230.4-1(a)(2)). Except in Plot D, the physical impacts of dredged material disposal on the water column will be temporary and directly related to the dewatering process. Although there is a shallow water column in the wetland areas of Plot D during spring tides, the physical impacts of filling those areas were discussed in 2.a above.

(1) Reduction in light transmission: Not significant.

(2) Direct destructive effects on nektonic and planktonic populations: Not significant. In the small and unimportant (according to EPA's 40 CFR 230.4-1(a)(1)) low areas of Plot D, the nektonic and planktonic populations would be displaced or destroyed. (See 2.a).

c. Covering of Benthic Communities (40 CFR 230.4-1(a)(3)).

(1) Actual covering of benthic communities is not expected to occur outside the disposal areas. Suspended fine grained particles in the spillway effluent are flushed away by tidal action. Normally the heavier particles settle out in the diked areas. Benthic communities (subject to flooding by spring tides) in Plot D would be eliminated as Plot D is filled with dredged material.

(2) Changes in community structure or function: Not significant outside dikes. Inside the dikes of Plot D, 20 acres of marginal wetlands associated with the man-made ditch would be replaced by sand and silt.

d. Other Physical Effects (40 CFR 230.4-1(a)).

(1) Changes in bottom geometry and substrate composition. Not significant, except in low areas of Plot D. (See 2.a).

(2) Water circulation. Not significant, except in low areas of Plot D now flooded by spring tides.

(3) Salinity gradients. Not significant.

(4) Exchange of constituents between sediments and overlying water with alterations of biological communities. Not significant.

3. Chemical-Biological Interactive Effects (40 CFR 230.4-1(b)).

a. Does the material meet the exclusion criteria? No. The nature of the top layer of dredged material (predominantly silt and sand) and the source will not allow the exclusion criteria to be met. However, the proposed dredged materials have a composition similar to that at or near the spillway sites, and sufficient chemical and biological testing has been conducted to insure the biological integrity of the receiving waters

b. Water Column Effects of Chemical Constituents (40 CFR 230.4-1(b)(3)).

(1) Charleston Harbor has a water classification of "SC". The Cooper River also has a water classification of "SC" in that portion below U. S. Highway 52 to the junction of the Ashley and Cooper Rivers. The S. C. Department of Health and Environmental Control defines "SC" waters as suitable for crabbing, commercial fishing and for the survival and propagation of marine fauna and flora. The Wando River is classified as "SB". "SB" waters are suitable for direct water contact and for survival and propagation of shellfish except shellfishing for market purposes.

(2)(a) Bulk chemical analyses of the sediments in Charleston Harbor were conducted in 1971, 1972 and 1975. These analyses indicate a general improvement in sediments with time, possibly due to the enforcement of progressively more stringent State and Federal regulations to control discharges and spills into the harbor. Since there are no State or Federal standards applicable to the components of dredged materials (State or Federal standards, where they exist for marine areas, are written for water

quality rather than sediments), a comparison was made between the most recent (1975) sediment samples from Charleston Harbor and sediment samples taken from locations in the Atlantic Intracoastal Waterway where one would expect to find non-contaminated material. (The AIWW samples meet the exclusion criteria for chemical testing.) Only lead was higher in Charleston Harbor than in the AIWW (mean values of 0.0018 and 0.0013 respectively).

(b) Because substances in the sediments may be tightly bound to sand, clays or organic particles and may not be available to the water column, the elutriate test is currently considered the best indicator of potential impacts on water quality (see 6.e.(7)). Unfortunately the State and Federal governments have very few standards for marine or estuarine water with which to compare the results of the elutriate tests. Where standards do exist, the elutriate levels are below the concentrations recommended for marine or estuarine waters. None of the elutriates or the concentration in the receiving waters could meet the EPA's "Redbook" recommendation (not an enforceable standard) of 0.1 ug/l for mercury. Each of the elutriates but one, however, had the same mercury levels as the receiving waters (0.5 ug/l) and would not affect the ambient mercury levels. At one elutriate sampling site, the mercury level was 2.0 ug/l, four times the level of the receiving waters. Since the receiving waters exceed the "Redbook" level, no amount of dilution would bring this elutriate level below the "Redbook" level; however, within a reasonable mixing zone the discharge level would approach that of the receiving waters. The 1979 levels of mercury in the liquid phases of the bioassay tests were significantly lower than the elutriate levels, but can not be directly compared since they are prepared by two different methods. Except for DDE in some samples, no pesticides or PCB's were detectable in any of the samples.

(c) Over a period of years, EPA has gradually retracted its position of setting standards in terms of absolute concentrations

for dredged material. Instead, applicable regulations now emphasize bioassays as an indicator of chemical and/or physical impacts. Although the levels of contaminants found in Charleston Harbor sediments do not warrant concern, bioassays have been conducted for the harbor sediments in anticipation of the ocean dumping alternative for the Charleston Harbor deepening project. The results of bioassays from the nine sites in the main channel, anchorage basin and Shipyard River show that at none of the sites would EPA's Limiting Permissible Concentration (LPC) be exceeded for the liquid phase, suspended particle phase or solid phase.

(d) In the bioaccumulation study there was considerable variability in the several controls. Where tissue in the control clams (*Mercenaria mercenaria*) showed exceptionally low levels of mercury or cadmium, tissue in clams from certain harbor sediments showed higher levels than these low controls. These same clams from harbor sediment, however, had comparable or lower levels than other controls. Where the controls were not exceptionally low, clams from harbor sediment compared favorably with their controls. A cross comparison among bioaccumulation controls indicated that tissue mercury and cadmium levels are within the normal variability of controls.

c. Effects of Chemical Constituents on Benthos (40 CFR 230.4-1(b)(3)).
Not significant. (See 3.a-b).

4. Description of Site Comparison (40 CFR 230.4-1(c)).

a. Total Sediment Analysis (40 CFR 230.4-1(c)(1)). Not required; however, see 1-b(3)(a) for a summary of the detailed sediment analyses conducted on grab samples and cores taken from Charleston Harbor.

b. Biological Community Structure Analysis (40 CFR 230.4-1(c)(1)).
Not applicable.

5. Review Applicable Water Quality Standards.

a. Compare Constituent Concentrations (See 3.a and b). Bulk chemical analyses, elutriate tests, bioassays and bioaccumulation tests provide a reasonable assurance that no Federal or State water quality standards will be exceeded.

b. Consider Mixing Zone. The majority of sediments will settle within the disposal area, entrapping pollutants. Heavy metals in particular have an affinity for the surface of clay particles. The contaminants remaining in the discharge from spillways should contain only a small fraction of the total pollutants emptied into the disposal area. Only mercury from one elutriate required dilution to meet "Redbook" recommendations or ambient levels. Because ambient water levels exceed "Redbook" levels, no mixing zone would bring this elutriate to "Redbook" levels, but a small mixing zone would dilute the discharge to close to ambient levels.

c. Based On a. and b. Above, Will Disposal Operation Be in Conformance With Applicable Standards? Yes. The "Redbook" concentration for mercury is only a guide. Bioassays indicate that this one mercury level and other contaminants will meet EPA and State requirements as set forth in regulations.

6. Selection of Disposal Sites (40 CFR 230.5) For Dredged or Fill Material. Disposal sites were originally selected based on pumping distances, environmental regulations and the willingness of the local sponsor to acquire suitable disposal sites. Tentative sites were located with the cooperation of the South Carolina Wildlife and Marine Resources Department to avoid unacceptable impacts on natural resources. The sites have been reviewed in light of Executive Order 11990, EPA's Section 404 regulations, and comments made by State and Federal agencies in response to the project EIS.

a. Need For the Proposed Activity. Charleston Harbor is a multi-purpose port which serves industrial, commercial, public and military establishments. Deep-draft tankers, general cargo vessels, container ships, dry bulk vessels and a variety of military vessels utilize the port. Unless deepened, Charleston Harbor would cease to be a major competitive port.

b. Alternatives Considered.

(1) No Action. Charleston Harbor would continue to be maintained at a depth of 35 feet. It would be unable to handle the increasing number of vessels with drafts greater than 35 feet. The larger ships would go to other ports to the detriment of South Carolina commerce, and the added transportation costs would be passed on to port users and eventually to the consumer. Commercial and industrial firms that require or desire to use the deeper draft vessels would not locate in the area served by the Port of Charleston.

(2) A variety of alternatives were examined in the early stages of planning, including a lighterage system, an offshore ocean terminal, a terminal at Cummings Point, light loading at Savannah and/or Wilmington, and a pipeline system. To satisfy the existing and future needs of the area served by the Port of Charleston, a considered alternative to channel modification must be capable of accommodating tanker and container vessels and their associated commerce. None of the above alternatives were viable in terms of meeting the physical and monetary requirements.

(3) Within the recommended alternative of deepening the harbor to 40 feet, there were several options as to placement of material. See 1.b. Ocean disposal has been studied at length and will probably be used instead of upland disposal, if the equipment needed is available at the time of construction.

c. Objectives To Be Considered in Discharge Determination (40 CFR 230.5(a)).

(1) Impacts on Chemical, Physical, and Biological Integrity of Aquatic Ecosystem (40 CFR 230.5(a)(1)). No significant impacts will occur as a result of the proposed discharge of dredged or fill material into the proposed disposal areas with the exception of the drainage canal bordering the south and west sides of Plot D and the lower priority wetlands associated with this canal. In this 20-acre area, the physical and biological integrity will be altered by the change from periodically (spring tide) flooded high brackish marsh and spring tide canal water to an area covered with silt and sand. This area will gradually be revegetated with upland species or used for growing crops two or more years after disposal.

(2) Impact on food chain (See 2.a(1) and 6.c(1)).

(3) Impact on diversity of plant and animal species (See 2.a(1)-(3) and 6.c(1)).

(4) Impact on movement into and out of feeding, spawning, breeding and nursery areas (See 6.c(1)).

(5) Impact on wetland areas having significant functions of water quality maintenance (See 6.c(1)).

(6) Impact on areas that serve to retain natural high waters or flood waters. No significant impacts.

(7) Methods to minimize turbidity. All disposal areas would be diked to minimize turbidity.

(8) Methods to minimize degradation of aesthetics, recreational and economic values. Recreational values will not be impacted. Economic values will be improved. There is no degradation of aesthetic values due to release from spillways. Alteration of the drainage canal and associated wetlands are described in 2a and 6.c(1).

(9) Threatened and endangered species. The only endangered species known to occur in the project area in recent years are the brown pelican, peregrine falcon and alligator. The proposed project would not jeopardize the continued existence of the aforementioned species. On the contrary, short-term impacts of the disposal areas would enhance habitat for the brown pelican. Furthermore, as the disposal sites dry and revegetate, feeding habitat for peregrine falcons would be enhanced through the establishment of early stage vegetation with associated small birds and rodents.

(10) Investigate other measures that avoid degradation of aesthetics, recreational, and economic values of navigable waters. See 6(b) and 6.c(8).

d. Impacts on Water Uses at Proposed Disposal Site (40 CFR 230.5(b)(1-10)).

(1) Municipal water supply intakes: No impacts.

(2) Shellfish: No significant impact.

(3) Fisheries: No significant impacts outside of the 20 acres of drainage canal and associated high salt marsh.

(4) Wildlife: No significant impacts outside of the 20 acres of drainage canal and associated high salt marsh at Plot D.

(5) Recreation: No significant impacts.

(6) Threatened and endangered species: The proposed project would not jeopardize the continued existence of any threatened or endangered species.

(7) Benthic life: (See 1.c.(2), 2.c.(1) and 2.d.(4)).

(8) Wetlands: (See 6.c.(1)). No significant impact, except for the canal and high wetlands at Plot D.

(9) Submerged vegetation: No significant impact.

(10) Size of disposal site: See c(1)d.

(11) Coastal zone management programs (40 CFR 230.3(e)): The South Carolina Coastal Management Plan was approved by the Department of Commerce on 24 September 1979. The Phase I study of deepening and extending channels in Charleston Harbor was reviewed and the study report prepared using the latest draft version of the program. Use of the proposed disposal areas is consistent to the maximum extent practicable with the South Carolina Coastal Management Plan. (See page 113)

e. Considerations to Minimize Harmful Effects (40 CFR 230.5(c)(1-7)).

(1) Water quality criteria: No significant effects on water quality. Diking reduces the turbidity introduced into receiving waters. (See also 3.a-b.)

(2) Investigate alternatives to open water disposal. The proposed alternative is an alternative to open water disposal.

(3) Investigate physical characteristics of alternative disposal sites. (See 6.b).

(4) Ocean dumping: Ocean dumping has been examined in detail (see Attachment 3), and would avoid the effects on upland Daniel Island sites. Ocean dumping will be employed instead of upland dumping if the special equipment is available at the time of construction.

(5) Where possible, investigate covering contaminated dredged material with cleaner material: Not applicable. (See 3.a-b).

(6) Methods to minimize effect of runoff from confined areas on the aquatic environment. No significant effects. Material would be held in diked areas before it is released to reduce turbidity. (See 1.c).

(7) Coordinate potential monitoring activities at disposal site with EPA. For Operations and Maintenance projects, monitoring of effluents from spillways would be a better basis on which to estimate the physical and chemical effects of the discharge than the elutriate and other methods now specified in EPA guidelines. Provisions for monitoring in lieu of elutriate tests have been suggested to EPA in their upcoming revisions to 404 guidelines.

7. Statement As To Contamination of Fill Material If From A Land Source (40 CFR 230.5(d)). Not applicable.

8. Determination of Mixing Zone. Based on past and projected disposal into the proposed disposal areas and bioassay and bioaccumulation tests, a mixing zone is not required to meet applicable standards or Limiting Permissible Concentrations. (See also 5.b and 3.a-b).

9. Conclusions.

a. Feasible alternatives to the proposed discharge have been considered, and none that can now be implemented will have less adverse impact on the open water and wetland ecosystem.

b. The proposed actions were selected from the feasible alternatives after adequate coordination with the public and State and Federal agencies.

c. There are no unacceptable environmental impacts on the open water and wetland ecosystem as a result of the discharge of dredged or fill material.

d. The discharge of the dredged or fill material will be accomplished in a manner that will minimize, to the extent practicable, adverse environmental effects on the open water and wetland ecosystem.

10. Findings. Based on the above evaluation and determinations, the proposed disposal sites have been specified through the application of Section 404(b) guidelines. Based on this document, the project EIS and other project documents available to me, I find that there are no viable alternatives for the disposal of the dredged material at this time which would have lesser impact on open waters and the adjacent wetlands. I also find that the proposed disposal is in the best overall public interest.

10 April 1980

Date

Milton Hunter
for WILLIAM W. BROWN
Colonel, Corps of Engineers
District Engineer

MILTON HUNTER
Major, Corps of Engineers
Deputy District Engineer

ATTACHMENT 2
BIOLOGICAL STUDIES FOR POTENTIAL DISPOSAL SITES ON DANIEL ISLAND

BIOLOGICAL STUDIES
FOR
POTENTIAL DANIEL ISLAND DISPOSAL AREAS

GENERAL. Deepening of Charleston Harbor may require upland areas for disposal of dredged material if equipment necessary for ocean disposal (preferred method) is not available at the time of construction (1985 - 1986).

The Charleston Harbor Deepening Project with a proposed 40-foot deep main channel would require approximately 1000 acres of upland for disposal. Subject to congressional approval, authorization and funding, construction of the project could begin by 1985. The deepening operation will require 2 to 2-1/2 years for completion.

Biological studies, in addition to those in the EIS, were recently made of five potential upland disposal sites on Daniel Island (see Plate 1). The five potential sites comprise approximately 2,500 acres of mixed openland and woodland. The five areas were evaluated separately and, should upland disposal be necessary, use of the 1000 acres which would have the least potential for adverse impacts is recommended.

ENVIRONMENTAL SETTING

Field studies of flora and fauna resources were made for each of the five potential sites on Daniel Island during June 1979. A description of each site follows:

Sampling Design - Field sampling of the study area was made through the use of the stratified random sampling method. Sample sites were selected from each vegetative cover type. Individual sites were selected on an aerial photograph with a scaled 200-foot interval transect axis. Individual points were located by using a random numbers table.

The number of sample sites taken per vegetative type varied from 2 to 10. Fewer sample sites were taken from the homogenous cover types, i.e., pine plantations and open cropland.

SITE A

Site A contains a mixture of cropland, hardwoods and pine woodland totaling 309 acres. Sixty-three percent (194 acres) of the site is prime farmland. Goldsboro and Bonneau soils are the predominant soil series. Primary crop production includes cucumbers, tomatoes, corn and soybeans. A network of drainage canals totaling 43,004 feet dissects the cropland.

Bottomland hardwoods totaling 115 acres comprise the second largest vegetative cover type. Predominant tree species include water oak, live oak, willow oak, sweetgum and black gum respectively. A few loblolly pine are scattered throughout. Wax myrtle, smilax, Vaccinium, American beauty berry, chain fern and grasses dominate the forest understory.

Age class of the hardwoods range predominantly from 20 to 80 years and are classed as heavy mast producers.

FISH AND WILDLIFE RESOURCES

Site A contains quality wildlife habitat for both game and non-game species (See Figures 3 and 4) for habitat values). The area is purposely managed for wildlife as well as agricultural products. Wildlife game species occurring in the area include whitetail deer, wild turkey, bobwhite quail, mourning doves, gray squirrels, fox squirrels, rabbits raccoons and opossums. Non-game species endemic to the lowcountry of South Carolina also occur in the area. Site A and adjacent Site B contain some of the highest wild turkey populations found in Berkeley County (personal communication - Bill Mahan - SCWMRD).

SITE B

Site B contains 841 acres which form the largest potential site. Fifty-six percent (471 acres) of the site is pastureland. The pastureland contains both improved pasture and native grasses. Fence rows and ditch rows thoroughly dissect the area. Various oaks, Sapium, loblolly pine, and wax myrtle border the fence rows and ditch rows.

Fifteen percent of Site B (129 acres) is prime cropland. Agricultural crops and practices are similar in Site B as with Site A. Approximately 40,324 feet of open ditches dissect the area.

Bottomland hardwoods total 204 acres. Flora composition is similar to Site A bottomland hardwoods. A total of 37 acres of loblolly pine are scattered throughout Site B. Age class and species composition includes 40-year old loblolly pine. Understory vegetation includes wax myrtle, grasses and annual herbs.

FISH AND WILDLIFE RESOURCES

Site B lies adjacent to Site A. Quality wildlife habitat is managed and maintained similarly in Site B as in Site A.

A high fox squirrel population occurs in the 471-acre pastureland-woodlot type habitat. The pastureland also provides habitat for other small mammals, birds, reptiles, and amphibians, and hunting grounds for birds of prey.

SITE C

This 228-acre tract is situated northwest of Beresford Creek. The entire tract is in woodland. More than 50 percent of the site is pine woodland.

Loblolly pine is the dominant species. Longleaf pine occurs in a strip in the northwest corner of the tract along contour elevations 20 to 25 feet.

Water oak, live oak, sweetgum and red maple are the predominant species comprising the 100 acres of bottomland hardwood.

FISH AND WILDLIFE RESOURCES

Bottomland hardwoods provide quality wildlife habitat. No fishery habitat occurs in Site C.

SITE D

Cropland comprises 78% (407 acres) of Site D. Cucumbers, tomatoes, corn and soybeans are the principal crops planted. A network of 100,960 feet of open ditches dissects the cropland. Eighteen percent (96 acres) of Site D is covered with hardwood trees. Predominant tree species include water oak, sweetgum and blackgum. Elderberry, chainfern, Ilex and various grasses dominate the understory. A large drainage canal with associated wetlands comprises approximately 20 acres of marginal salt marsh. The wetland is bounded by existing dikes and is fed by a man-made canal constructed to drain an existing disposal area. Vegetation consists of smooth cord grass and black needlerush.

FISH AND WILDLIFE RESOURCES

Openland wildlife species are favored in Site D with its large expanse of open cropland. However, an interspersation of fence rows plus the close proximity of fields to woodlots provides limited but good habitat for woodland wildlife species such as whitetail deer and wild turkey. Limited fishery habitat is provided during high tide in the southwest perimeter drainage canal.

SITE E

Site E is a former dredged material disposal area. Dredged material was last pumped on the site during the late 1960's. The site is still inclosed by the former dike.

Shortly after the dredged material had dried sufficiently for equipment to stand (1 to 2 years), a network of 40,880 feet of open ditches was installed for field drainage. Since that time, Site E has been planted in tomatoes, cucumbers and soybeans. Crop yields equal those in nearby prime farmlands. Common vegetation in and adjacent to the open ditches include dog fennel, ragweed, various grasses and cattail.

Approximately 88% (477 acres) of the site is cropland. The remaining 12% of the site which includes the vegetated dike and wooded corners contain hardwood vegetation.

Predominant tree species include sugarberry, mulberry, groundsel, Sapium and chinaberry. Other vegetation includes sumac, pokeberry, milkweed, bermuda grass, dock, vassey grass and dog fennel.

FISH AND WILDLIFE RESOURCES

The large open areas of Site E favor fair openland wildlife habitat. No fishery habitat occurs in Site E.

THREATENED AND ENDANGERED WILDLIFE

The Endangered Species Act of 1973 (PL 93-205) establishes two categories of endangerment:

Endangered Species: Those in danger of extinction throughout all or a significant portion of their range.

Threatened Species: Those likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

The Federal endangered species list of 17 January 1979 includes the following species which occur or may occur in the South Carolina coastal region; however, few of the species have been observed, are known to be present, or are believed to be present in the potential disposal sites.

a. Reptiles.

Leatherback sea turtle	-	(E) Endangered
Atlantic Ridley sea turtle	-	(E)
Green sea turtle	-	(T) Threatened
Loggerhead sea turtle	-	(T)
American alligator	-	(T)
Eastern indigo snake	-	(T)

The sea turtles are visitors to beaches of South Carolina. None have been observed in the vicinity of Daniel Island. The eastern indigo snake may exist in South Carolina, which is the northern limit of its historic range. However, it has not been recorded in the Daniel Island area.

b. Birds.

Arctic peregrine falcon	-	(E)
Bachman's warbler	-	(E)
Brown pelican	-	(E)
Eskimo curlew	-	(E)
Kirtland's warbler	-	(E)
Ivory-billed woodpecker	-	(E)
Red-cockaded woodpecker	-	(E)
Bald eagle	-	(E)

The Arctic peregrine falcon is a winter migrant and is occasionally sighted in the area. The Bachman's warbler, Kirkland's warbler, and Eskimo curlew are transients, and have not been sighted in the area. The red-cockaded and ivory-billed woodpeckers have not been observed in the area. The bald eagle is a permanent resident of South Carolina and nests in estuarine areas; however, none reside in the area. The brown pelican is commonly observed along the Carolina coast.

c. Mammals.

Eastern cougar	-	(E)
Florida manatee	-	(E)

The cougar has not been observed in the study area. The Florida manatee or sea cow, resides in tropical waters, particularly in Florida, but occurs occasionally as a straggler along the South Carolina coast. In August 1977, two were seen at Beaufort, South Carolina, and in recent years some have been reported from the Cape Fear estuary in North Carolina. It is highly unlikely that the cougar or manatee occur in the Daniel Island vicinity.

d. Fishes.

Shortnose sturgeon	-	(E)
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Sturgeon regularly inhabit the Cooper and Wando Rivers.

SUMMARY SHEET

VEGETATIVE COMMUNITIES - OPEN DRAINAGE DITCHES - ROADS - FARM STRUCTURES

PROPOSED DISPOSAL SITES

DANIEL ISLAND

<u>VEGETATIVE COMMUNITIES</u> (acres)	<u>SITE A</u>	<u>SITE B</u>	<u>SITE C</u>	<u>SITE D</u>	<u>SITE E</u>
Cropland	194	129	0	407	477
Pastureland	0	471	0	0	0
Forestland					
Hardwood	115	204	100	96	65
Pine	0	37	128	0	0
Marshland	<u>0</u>	<u>0</u>	<u>0</u>	<u>20</u>	<u>0</u>
TOTAL	309	841	228	523	542
<u>OPEN DRAINAGE DITCHES (feet)</u>	43,004	40,324	0	100,960	40,880
<u>ROADS (feet)</u>	26,800	58,400	2,000	30,000	25,600
<u>BUILDINGS - FARM STRUCTURES</u> (no.)	1	8	0	0	0

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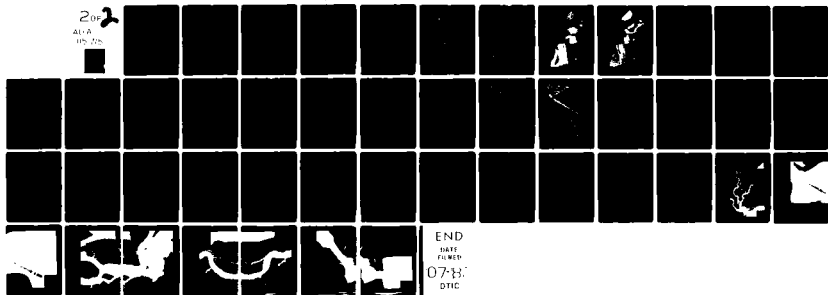
CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT
DEEPENING AND EXTENDING CHANNELS FOR NAVIGATION, CHARLESTON HAR--ETC(U)
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FUTURE ENVIRONMENTAL SETTING WITHOUT THE PROJECT

Major land management changes are anticipated for the Daniel Island area within the next decade. Completion of the Mark Clark Expressway by the year 1986 will directly link Daniel Island to the North Charleston-Charleston, and East of the Cooper areas. It appears probable that some residential and industrial development of the island will occur upon completion of the expressway. This type of land development would replace the valuable game and non-game wildlife habitat which now occurs on Daniel Island. As land development increases, many of the wildlife game species now present would be replaced by songbirds and other forms of wildlife commonly associated with a residential environment.

In summary, predictions for the future environmental setting of Daniel Island indicate a change of rural lands to urban and industrial lands. These predicted land use changes will occur with or without the proposed project.

IMPACTS OF DREDGED MATERIAL DEPOSITION ON THE ENVIRONMENTAL SETTING

GENERAL:

Approximately 1,000 acres of upland would be needed for deposition of about 12,609,000 yards of dredged material from the initial deepening. Individual selected sites would be impounded within a 12-foot high dike. Approximately four to eight flashboard risers (eight feet in diameter) would be installed in the back dike opposite the intake point. The flashboard risers would provide controlled drainage during periods of dredged material deposition.

Selected disposal sites would be cleared of coarse vegetation prior to deposition. The period of construction and deposition would be 2 to 2-1/2 years. Following deposition, a normal drying and soil-salt leaching period would require about two years, after which, the sites would be suitable for normal agricultural cropping practices. High yielding vegetable crops, including salt tolerant varieties of tomatoes and cucumbers, have been developed for use in similar sites.

IMPACTS:

The effects and impacts of dredged material deposition would produce varying intermediate-term and long-term effects on each potential site. Short-term conditions (0-5 years) would be essentially identical on each site. However, the impacts would vary on each site according to the vegetative community and value of habitat involved.

Construction of disposal sites would require the removal of existing vegetation and dike construction. Wildlife species currently within selected disposal sites would be forced into adjacent habitats. The time "interval-displacement" for fish and wildlife habitats would vary with the age class of the existing vegetative communities.

A mud-slurry type condition would prevail from the initiation of pumping dredged material until the site dries sufficiently for equipment to stand. This process would create a homogenous type of open mudflat habitat. Wildlife use in the disposal area during this time would be limited to feeding herons, egrets, plovers, sandpipers, dunlin, willets, black-necked stilts, gulls, crows, various other bird species, raccoons and other small mammals.

Following the short-term impacts, the intensity and amounts of intermediate-term and long-term impacts on fish and wildlife resources would vary from none to moderate depending on the disposal site selected. Impacts on individual sites follows:

SITE A

Sixty-three percent of Site A is currently in cropland. Cropfields could be re-established on the site within five years following initiation of disposal of dredged material. As a result, there would be only minimal or no intermediate-term or long-term adverse effects of disposing dredged material on 194 acres of cropland.

Long-term adverse impacts on wildlife habitat would be evident in 115 acres of forestland. Approximately 40 years would be required to produce quality bottomland hardwoods comparable to the existing stand. During the regrowth period, woodland wildlife species "populations", including whitetail deer, wild turkey and gray squirrel would be lower than existing populations. However, woodland wildlife use of the area and the quality of habitat would increase directly with increased stages of reforestation.

SITE B

Cropland and pastureland comprise seventy-one percent of Site B. Both land management practices could be reestablished within five years with no long-term adverse effects to agriculture. However, removal of fence rows and ditch row trees from the pastureland would reduce fox squirrel

habitat over a longer period. The removal of trees in 241 acres of forestland would have similar effects on woodland wildlife species as in Site A.

SITE C

Site C consists entirely of forestland. Woodland wildlife species can be expected to abandon the site during land clearing and disposal operations. However, wildlife use of the area and the quality of habitat would increase directly with increased stages of reforestation.

SITE D

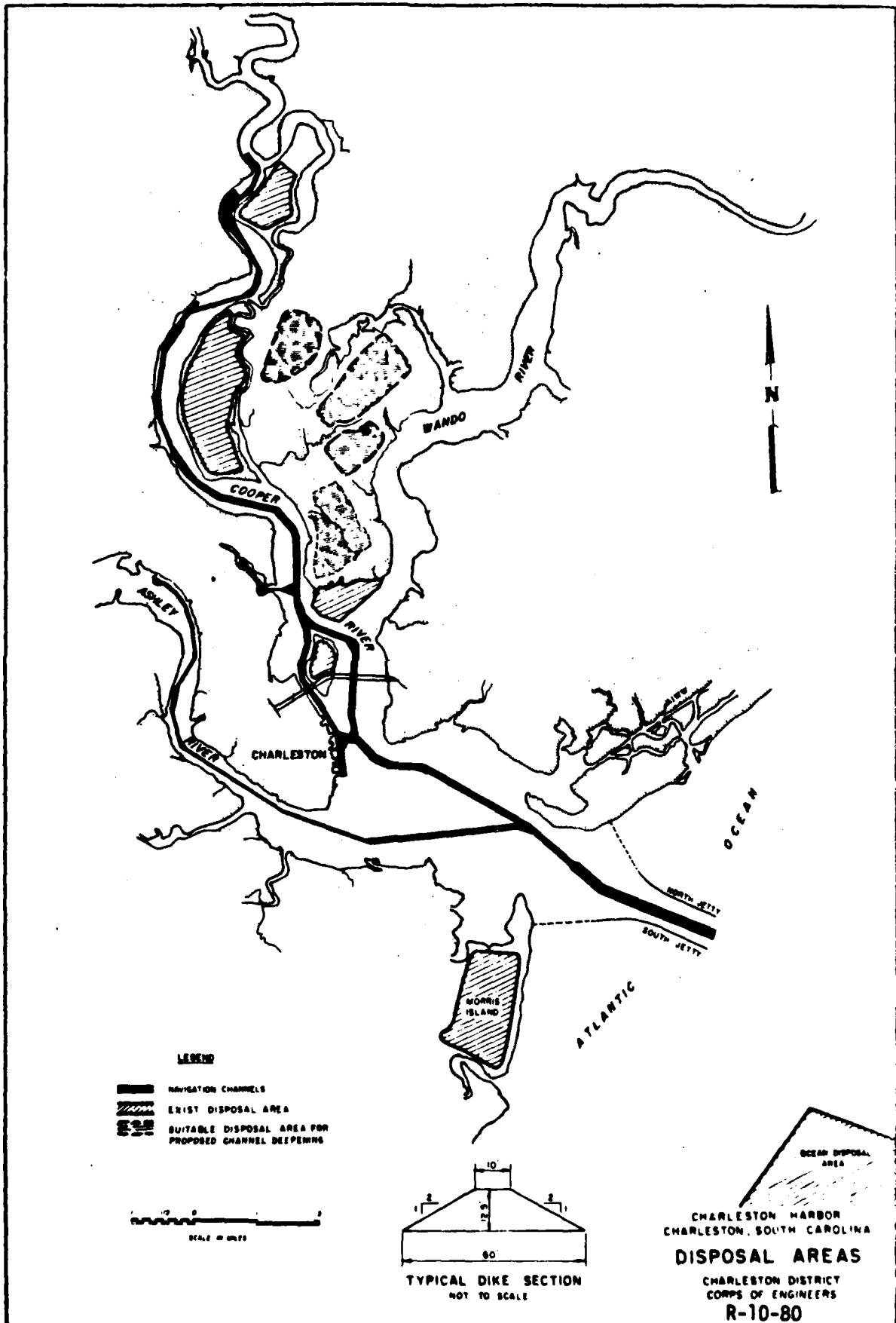
Cropland comprises seventy-eight percent of Site D. Reestablishment of the cropland as currently practiced, could be accomplished within five years following initiation of dredged material disposal. Eighteen percent of Site D (96 acres) contains hardwood trees. Impacts on woodland wildlife species would be similar to those described for Site A, i.e., about 40 years would be required to replace some of the mature hardwoods. To the extent that some losses of wooded areas would occur without the project, the impact attributable to the project is lessened. Selected replanting of hardwood trees and shrubs would be included if use of upland areas is necessary. The sum total of long-term adverse impacts on openland and woodland wildlife species would be considerably less in Site D than the previous mentioned sites. Disposal operations would fill the large drainage canal and associated marginal wetland areas. New drainage canals would be constructed after disposal activities are completed.

SITE E

The majority of this former disposal area (88%) is in agricultural row crops. Reestablishment of Site E to cropland could be made within five years following initiation of disposal of dredged material. Adverse impacts on wildlife would be short-term and minimal.

IMPACTS ON THREATENED AND ENDANGERED WILDLIFE

The only endangered species known to occur in the potential disposal areas in recent years are the brown pelican, peregrine falcon and alligator. The proposed project would not affect the continued existence or critical habitat of the aforementioned species; therefore, formal consultation under Section 7 of the Endangered Species Act, as amended, appears unnecessary for these upland sites.



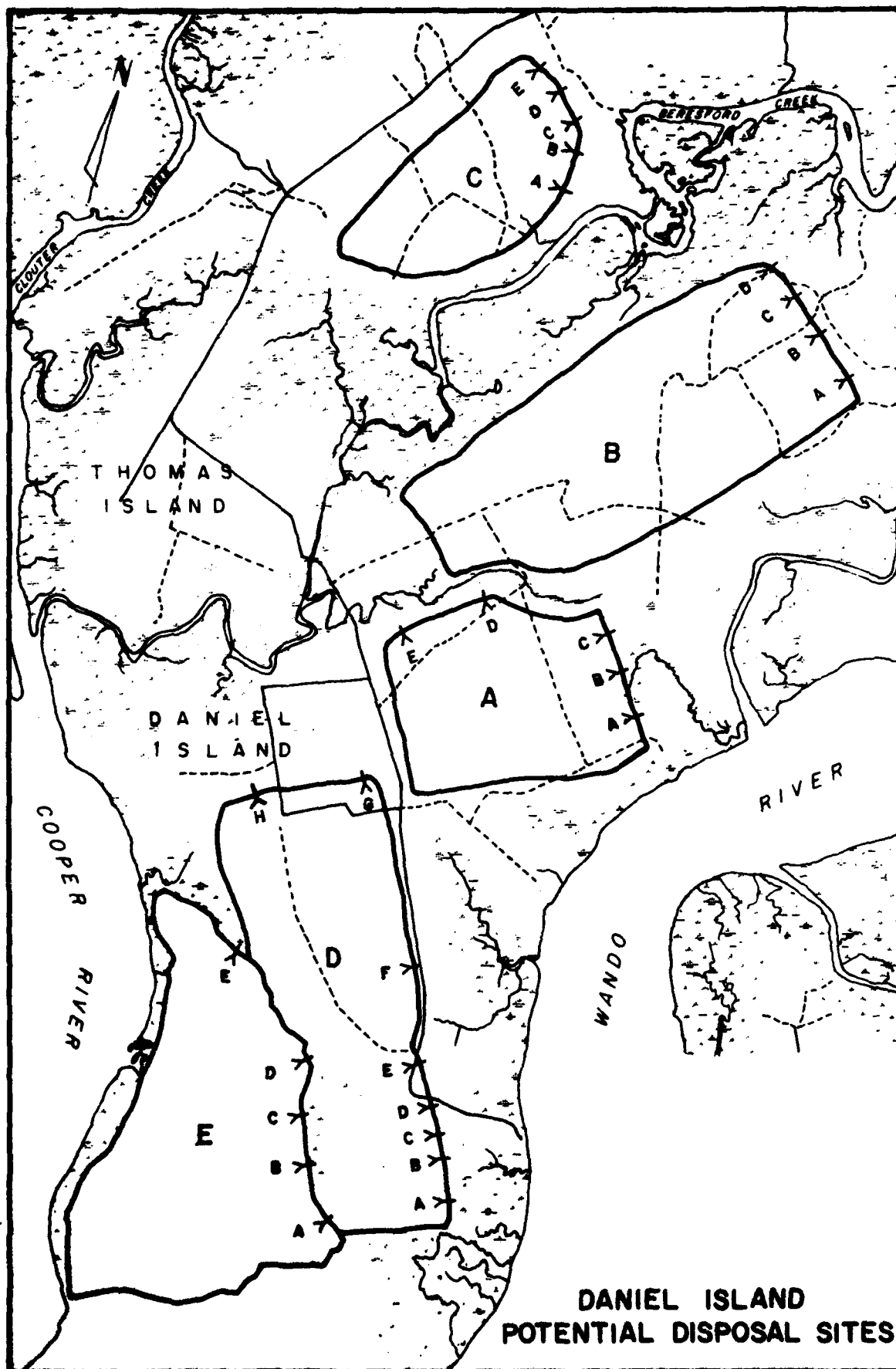


FIGURE 2

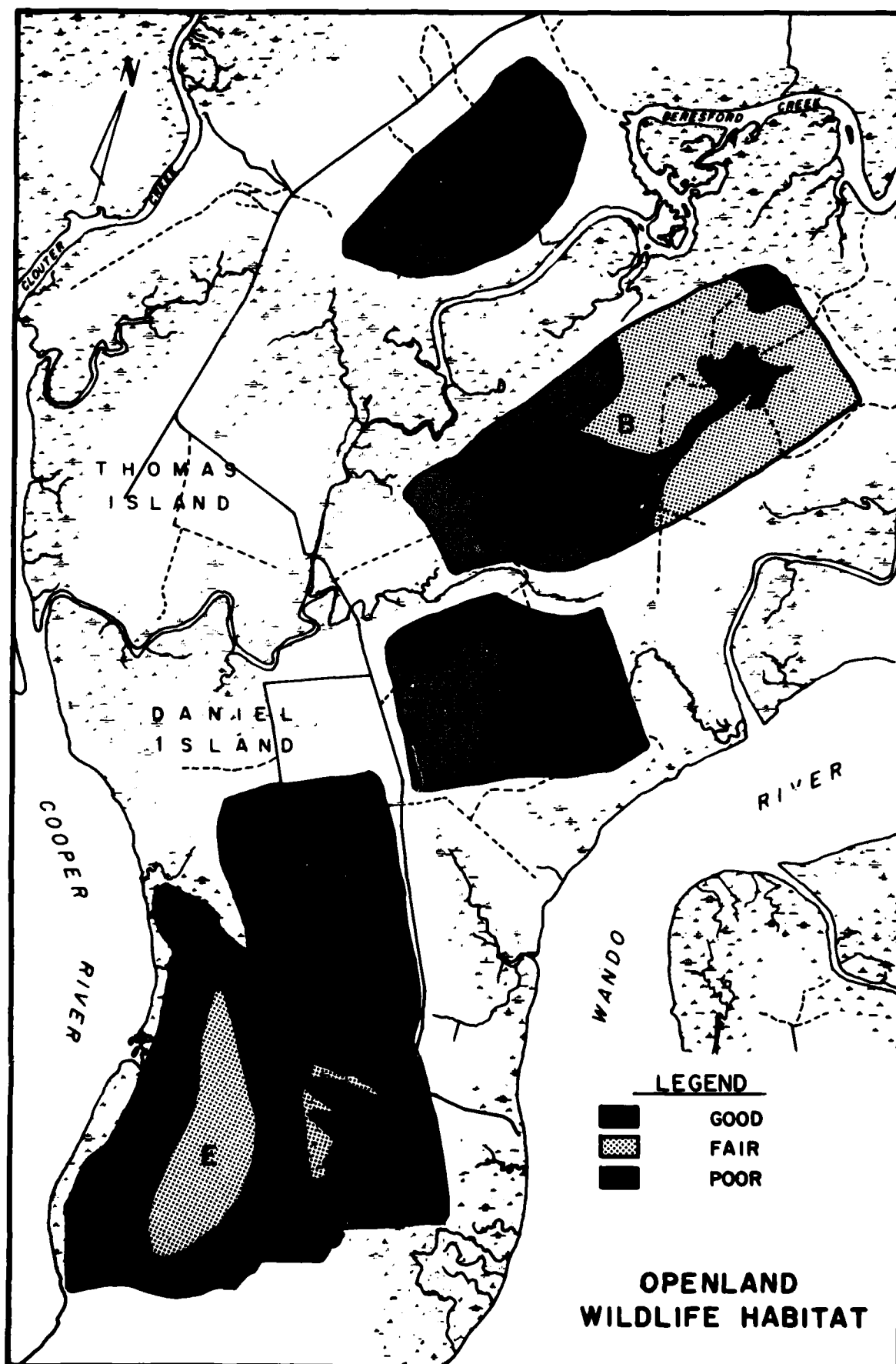


FIGURE 3

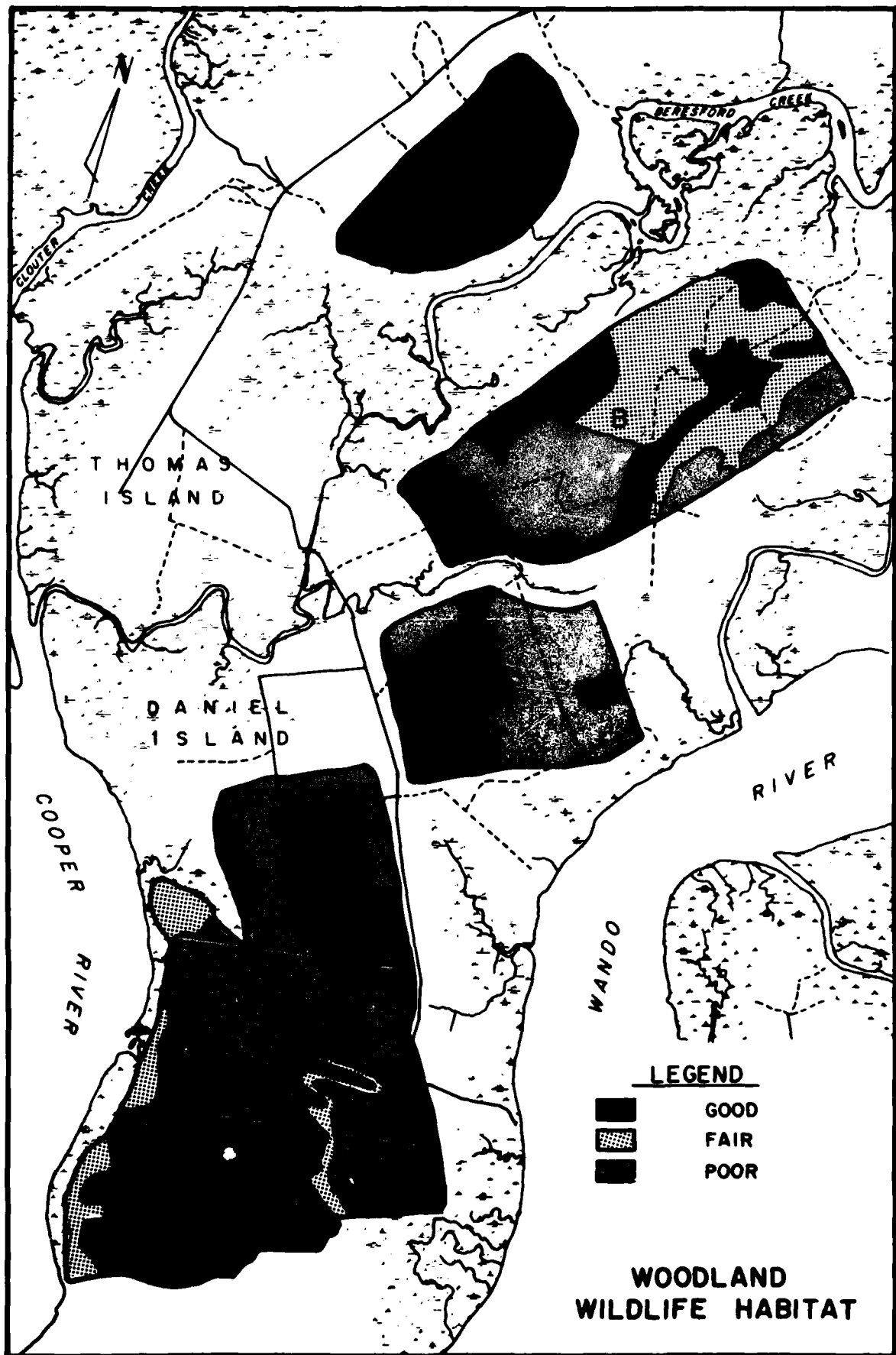


FIGURE 4

ATTACHMENT 3
OCEAN DUMPING - EVALUATION OF IMPACTS

OCEAN DUMPING AND THE MARINE PROTECTION,
RESEARCH AND SANCTUARIES ACT OF 1972

The 1976 Final EIS discussed the removal of 12,095,000 cubic yards of material from the entrance channel, its disposal at an EPA-approved interim dump site and the impacts of this ocean disposal. In its evaluations of various plans, the EIS also discussed the advantages of ocean dumping inner harbor material; but, since the special equipment needed was not available, the EIS indicated that upland disposal of inner harbor material was the best feasible alternative. Since the preparation of the Final EIS, EPA has developed final regulations (40 CFR 227) for testing and evaluating the disposal of dredged material at ocean sites. During Phase I, ocean disposal of material from the Charleston Harbor Deepening Project has been reevaluated using the latest (11 January 1977) EPA criteria. Materials from the entrance channel (for which ocean dumping was proposed in the feasibility report and Final EIS) and materials from the inner harbor (for which ocean disposal now appears feasible) meet the EPA criteria. If the special equipment is available at the time of construction, ocean dumping of inner harbor material will probably be employed in place of upland disposal.

EPA Criteria.

227.4 In meeting the criteria of 40 CFR 227.4-13, the dredged material disposal "will not unduly degrade or endanger the marine environment," and the disposal will present:

- a. No unacceptable adverse effects on human health and no significant damage to the resources of the marine environment;
- b. No unacceptable adverse effect on the marine ecosystem;
- c. No unacceptable adverse persistent or permanent effects due to the dumping of the particular volumes or concentrations of these materials; and,

d. No unacceptable adverse effects on the ocean for other uses as a result of direct environmental impact.

227.5 None of the materials proposed for ocean disposal are "prohibited materials" as defined in this paragraph of the EPA regulations (e.g., no radioactive wastes, chemical or biological warfare products, persistent synthetic materials or insufficiently described materials).

227.6 None of the constituents of the material proposed for ocean disposal are present other than as trace amounts. EPA defines "trace amounts" as quantities which when dumped will not cause "significant undesirable effects". The potential for causing "significant undesirable effects" is determined by application of results of bioassays on liquid, suspended particulate and solid phases of the dredged material. Bioassay and bioaccumulation studies have been conducted on materials from 17 sites in the entrance channel and in the inner harbor. The results indicate that there would be no violations of "applicable water quality criteria" and no significant mortalities or significant sublethal effects (including bioaccumulation and chromic toxicity) in any of the three phases of the materials from Charleston Harbor. Summaries of the bioassays are included in paragraph 227.27-32 below. The complete reports are available in the Charleston District.

227.9 The quantity of material removed from the entrance channel and the inner harbor by dredging is miniscule when compared to the total transport budget of the natural system. Studies on previous use of the disposal area for deposition of entrance channel material indicate no cumulative or long-term effects: See 227.13 and 227.17-32 below.

227.10 The dumping of entrance channel materials at the EPA approved dump site (as proposed in the feasibility report and Final EIS) will not present any obstacle to fishing or navigation and will cause no unacceptable danger to shorelines or beaches. Should it become practicable to ocean dump materials from the inner harbor at a later date, a pilot study or current-sediment transport study should be made to demonstrate that the fine silts and clays will not be carried to nearby beaches. Bioassay and bioaccumulation studies show that the material is safe for ocean disposal.

227.13(b)(1) Material from the entrance channel is predominantly sand; is found in an area of high current energy; and thus meets these exclusion criteria. Material from the inner harbor (not proposed for ocean dumping at this time) is predominantly silts and clays. This inner harbor material differs from the substrate at the ocean disposal site and does not meet the exclusion criteria.

227.13(c)(2) Bioassays on all solid, liquid and suspended particulate phases of dredged material show that it can be discharged so as not to exceed the limiting permissible concentrations (LPC's). See also 227.27-32.

227.14-16 Need for ocean dumping. Pursuant to Section 103 of P. L. 92-532, the Corps has made "an independent determination as to the need for the dumping" and has also made "an independent determination as to other possible methods of disposal and as to appropriate locations for the dumping." The need for the dumping and alternatives are summarized in the main body of the Phase I report. There are no practicable alternative disposal practices for disposal locations which would have less impact on the environment.

227.17-22 As a result of bioassays, bioaccumulation studies, benthic studies of the ocean disposal site; and considering the overall resources of the project area (described in Final EIS and Supplemental Information Report), the District Engineer has determined that there is no potential for significant impacts as a result of ocean disposal on esthetic, recreational or economic values, and no significant impact on other specific uses of the ocean, including commercial fishing, recreational fishing, use of shorelines and beaches, navigation, exploration of living and non-living marine resources and research potential.

227.27-32. Mixing zones and limiting permissible concentrations (LPC's) were calculated for each of the sediment samples. Separate summaries and conclusions are provided for tests of the entrance channel material and for tests of the inner harbor material.

SUMMARY AND CONCLUSIONS ENTRANCE CHANNEL

1. Sediments from four sites (Fig. 5) in the entrance to Charleston Harbor, South Carolina, were bioassayed following Federal guidelines as outlined in the EPA/CE Manual*. All four sediments fully comply with regulations for safe ocean disposal.

2. Suspended particulate and liquid phases meet all bioassay and dilution criteria. No limiting permissible concentration (LPC) would be approached during this disposal.

3. There were no indications of toxicity in any of the solid phase bioassays.

4. Chemical analyses of the liquid phase found no constituents to be greatly elevated over seawater controls, and no LPC would be approached except that for cadmium. Seawater and the liquid phases had the same cadmium content, but the seawater content is fourteen times the limiting permissible concentration. No pesticides or PCB's were detectable in any of the samples.

5. Laboratory experiments found no tendencies for any bioaccumulation of petroleum hydrocarbons, chlorinated hydrocarbons, mercury or cadmium from any of the test sediments.

6. The disposal vessel, traveling at 1.5 m/sec, will require 800 seconds to empty a full capacity load of 1600 m³. The median water depth at the disposal site is 12.5 m (10-15 m). These figures yield a calculated dilution factor of 0.00032 or 0.032% after the four-hour initial mixing period.

*Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material, "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters; Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research, and Sanctuaries Act of 1972)," July 1977, Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

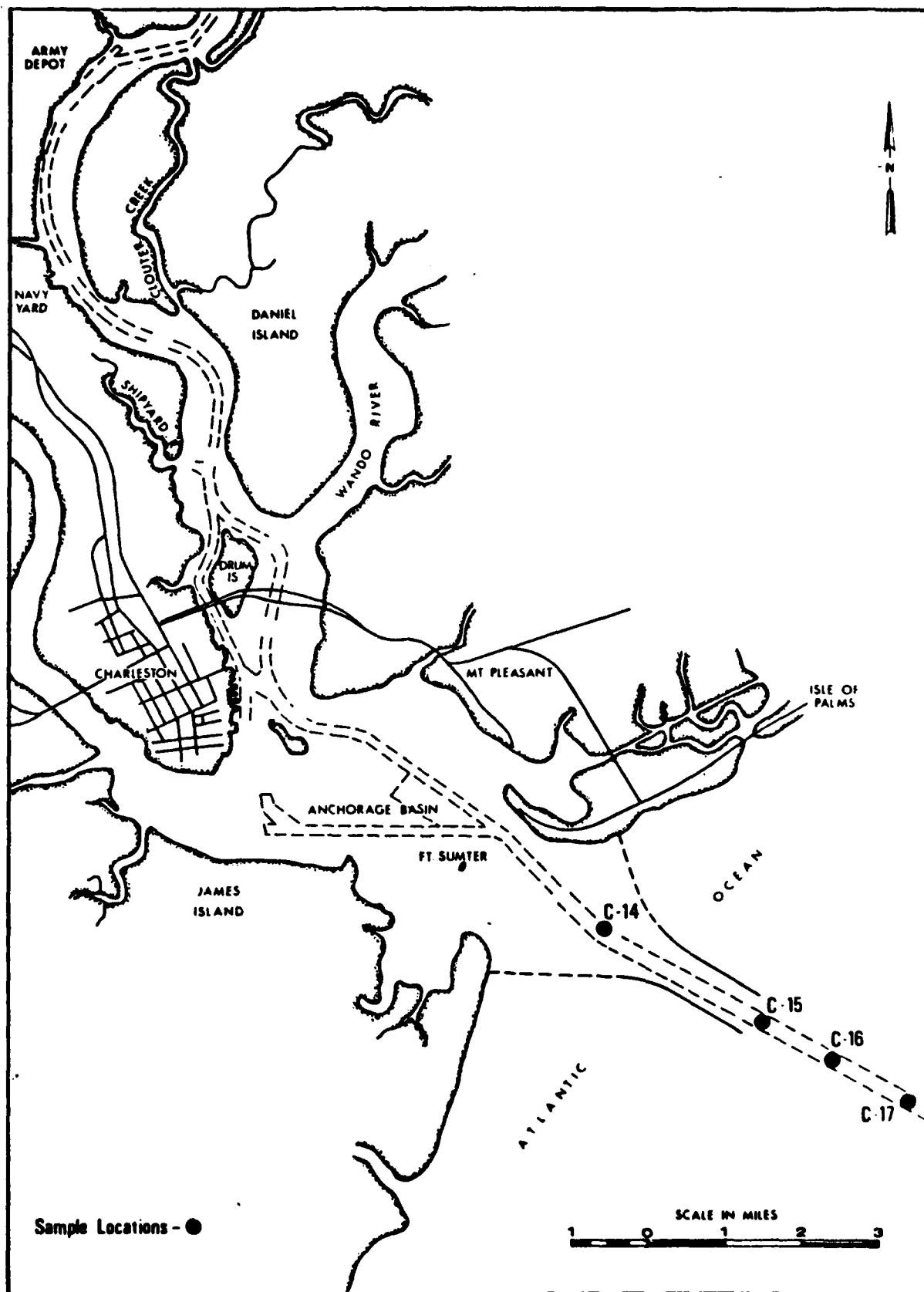


FIGURE 5 Sample locations for sediments used in tests.

SUMMARY AND CONCLUSIONS

INNER HARBOR

1. Sediments from nine sites in Charleston Harbor and from four sites in dredge spoil disposal areas were sampled, and their safety for ocean disposal was tested following Federal guidelines as outlined in the EPA/CE Manual*. Tests included three-phase bioassays with four locally abundant species, liquid phase chemical analyses, and bioaccumulation tests.

2. None of the thirteen sediments would exceed any limiting permissible concentration (LPC) based on suspended particulate or liquid phase bioassays.

3. Of the 52 solid phase bioassays performed (13 sediments x 4 species) only four differed from controls, and none of the tests predicts surpassing of the LPC.

4. None of the liquid phase chemical analyses revealed any important differences from disposal site seawater except for DDE in most samples. The LPC for DDE would not be exceeded if seawater DDE content is assumed to be no greater than 70% of the LPC (below detection limits). The seawater itself has a cadmium (Cd) content fourteen times the LPC, and therefore all liquid phases necessarily exceed the LPC even though many have Cd levels below seawater and the highest are only 71% above seawater.

5. In the bioaccumulation tests, clams in several of the sediments showed tissue concentration of mercury or cadmium significantly higher than their controls, which showed exceptionally low levels compared to other controls run in Charleston and under the same conditions. Where metals content was significantly higher in clams from harbor

*Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material, "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters; Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research, and Sanctuaries Act of 1972)," July 1977, Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

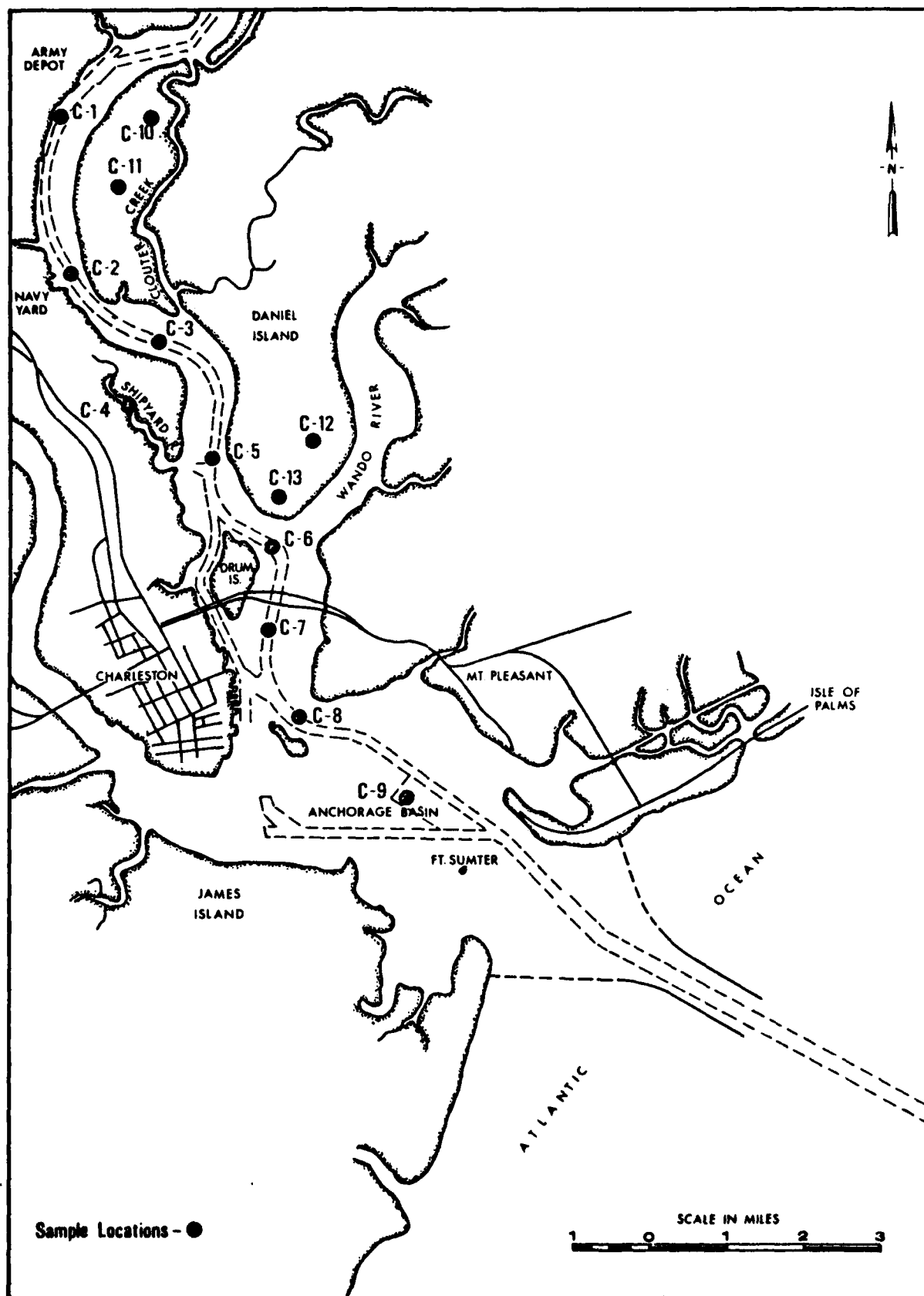


FIGURE 6 Sample locations for sediments used in tests.

sediments than in their controls, in all cases the metals content was comparable to or lower than that in other controls. No petroleum hydrocarbons or chlorinated hydrocarbons were detected in any of the clams from the bioaccumulation tests.

6. The disposal vessel, traveling at 1.5 mm/sec., will require 800 seconds to empty a full capacity load of 1600 m³. The median water depth at the disposal site is 12.5 m (10-15 m). These figures yield a calculated dilution factor of 0.00032 or 0.032% after the four-hour initial mixing period.

Choice of ocean disposal sites. Based on preliminary studies on the general characteristics of the ocean disposal site, EPA has granted interim approval for its use. A summary of previous studies of the site was presented in the FEIS. As part of the Phase I study for the Charleston Harbor Deepening Project, additional studies were conducted to evaluate the impacts of current annual disposal practices at the site and to assess the suitability of the site for disposal of material dredged during the channel deepening. A summary of the study follows.

CONCLUSIONS OF BENTHIC STUDIES AT THE OCEAN DISPOSAL SITE

The Charleston Harbor Ocean Disposal Area is located on the inner continental shelf midway along the coast of South Carolina. Water depths in the area vary from about 10-16 m, and bottom sediments are sandy. Investigations were conducted in and adjacent to the Ocean Disposal Area during the summer and autumn of 1978 to assess the benthic communities and sediment characteristics of the area in relation to disposal of dredged materials over the site.

Waters of high salinity and moderate dissolved oxygen content cover the study area. During August field sampling, salinities varied from 31.32-35.88⁰/oo, while oxygen concentrations ranged from 4.0-6.9 mg/l. Turbidities decreased progressively with increasing distance from shore, so that water clarity was markedly greater offshore.

Shifting sands provide an unsuitable substrate for most sessile species, and the study area was sparsely populated with epifaunal invertebrates except in areas where accumulations of large shells were present. The number of species in dredge collections varied widely from one station to another. These differences were related to the presence or absence of suitable substrate rather than any effects from disposal of dredged materials in the area. The amount of material collected by the dredge was small at each of the 40 stations sampled. Although sponges, octocorals, hydroids, bryozoans, and ascidians were occasionally taken in the dredge, no live bottom areas were found anywhere in the study area. No noteworthy differences in epifaunal composition were detected between the Ocean Disposal Area and adjacent sites outside that could be directly attributed to disposal practices.

Although the bottom of the study area appears to constitute a relatively uniform habitat, an unexpectedly large variety of infaunal invertebrates were found in grab samples. Thorough taxonomic workup of these collections resulted in the identification of 493 species. This study shows that benthic communities of the inner continental shelf in this region are faunistically richer and have higher species diversity than previously thought. Most of the constituent species are small, and polychaete worms dominated the fauna both in numbers of species (211) and overall abundance (37.5% of the fauna). The most abundant species was the lancelet Branchiostoma caribaeum, a seasonally abundant organism which accounted for nearly 20% of the total number of animals collected. Lancelets were found in much greater concentrations than have been recorded before from the southeastern continental shelf, reaching maximum densities of 2788 individuals m^{-2} . The detailed account of benthic community structure provided by this report provides a data base for appraising the effects of future dredged material disposal in the area.

Variation in species numbers, faunal density, species diversity, and species richness were noted from one station to another. However, differences between sites inside and outside the Ocean Disposal Area were not statistically significant. No effects of dredged material disposal were detectable on either epifaunal or infaunal communities. Such practices have probably had little lasting impact on the macrobenthos because of the similarity of dredged materials to the existing sediments of the disposal area. On the other hand, the impact of dredged materials of a different particle size, such as silts from Charleston Harbor, would probably be significant if these sediments were not rapidly diluted and dispersed from the area by water currents. If such materials settled to the bottom of the disposal area, the impact would be detrimental to the types of organisms presently inhabiting the site.

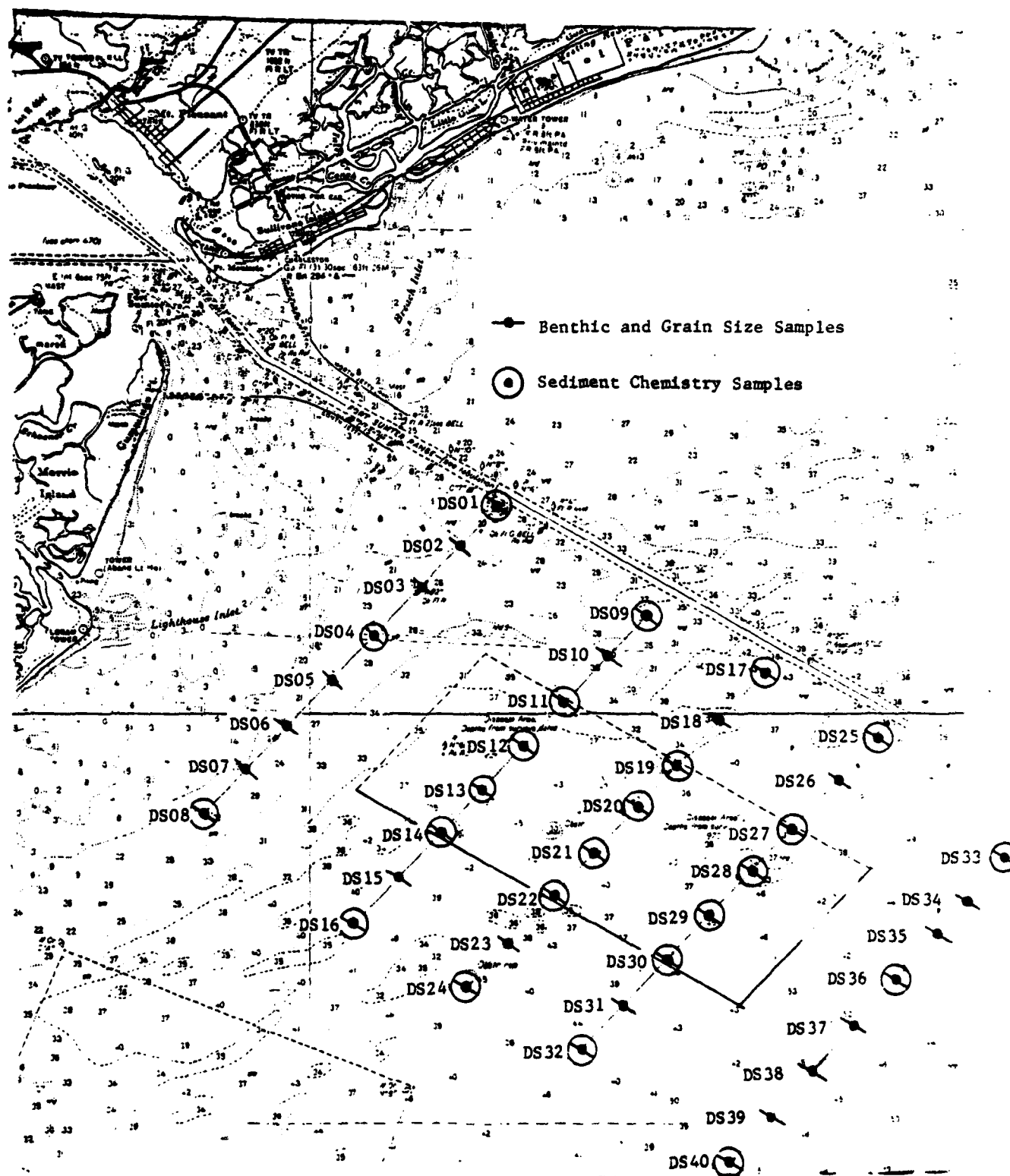


Fig. 7. Location of the Charleston Harbor Ocean Disposal Area and the sampling stations.

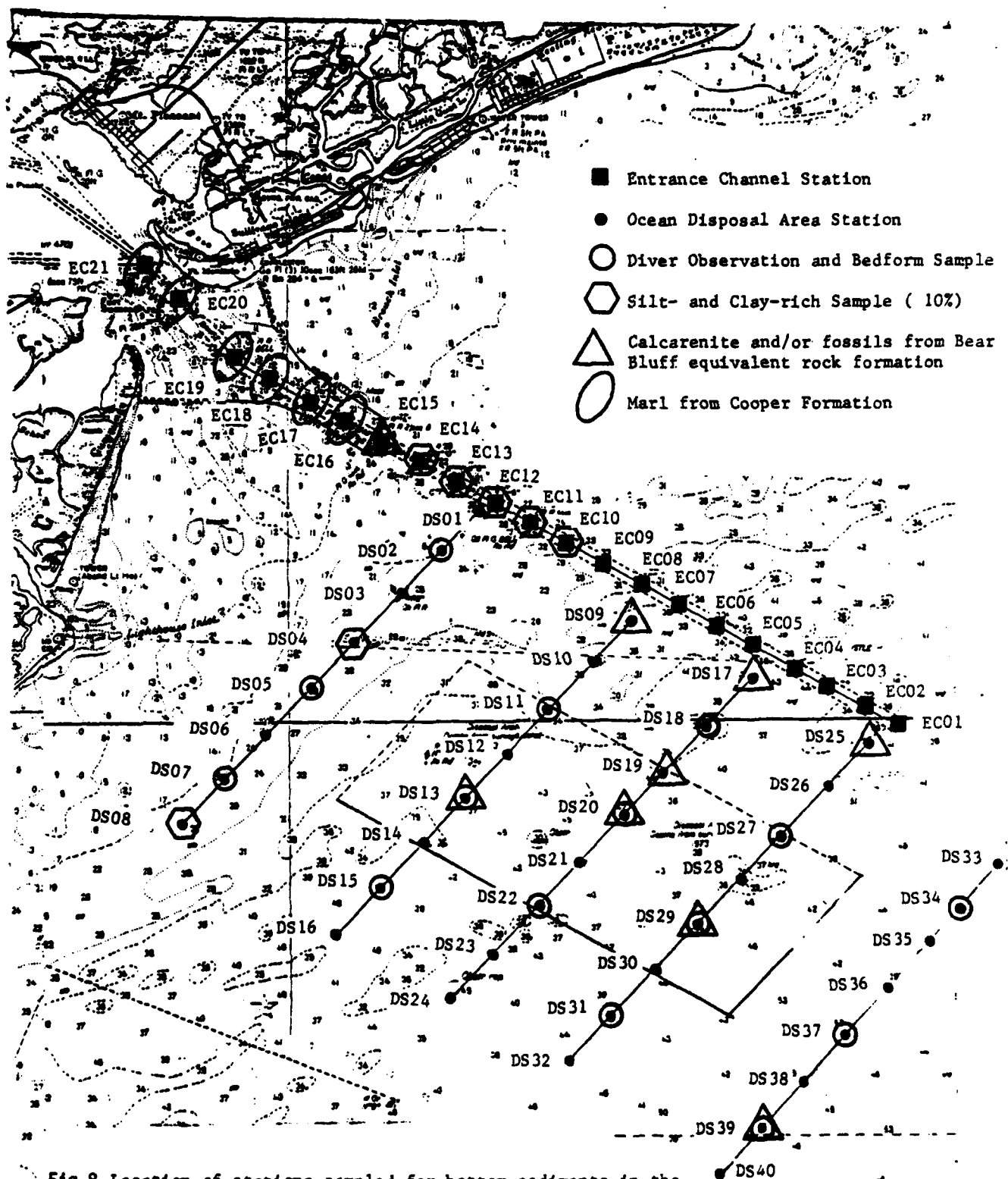


Fig.8 Location of stations sampled for bottom sediments in the Charleston Entrance Channel and Charleston Harbor Disposal Area.

The only direct evidence of Entrance Channel spoil found in the study area was the presence of fresh calcarenite pebbles and fossils from geologic formations exposed on the bottom between the jetties. The sandy bottom throughout the study area is ripple marked, an indication that swell and sea move sediment over the entire region - no portion of the study area can be considered to be below "wave base." There are a minimum of 6 unique textural or grain size groups present in the study area, only one of which is restricted to the Disposal Area proper. Isolated point sources characterize the geographic distributions of 3 of these groups and are indirectly indicated for 2 more. One group is distributed in shore-parallel bands with members being concentrated in the nearshore bands and deficient in the offshore.

EPA has a firm under contract to gather data on Charleston's interim approved site. The results of the EPA contracted study will be reviewed with the Charleston District studies, and final EPA approval of the Charleston ocean dump site is expected in 1980.

In summary, several studies have been conducted, both on the dredged material and on the ocean disposal sites proposed for use in the deepening of Charleston Harbor. Although a considerable amount of new information was provided, no significant impacts were disclosed that were not considered in the Final EIS.

ATTACHMENT 4
CULTURAL RESOURCES

CULTURAL RESOURCES

As discussed in the section dealing with the Clean Water Act and the 404(b)(1) evaluation, the five plots of land shown in Figure 2 are tentative sites. Specific tracts of land for disposal of dredged material are not acquired until the later stages of planning when the local sponsor has been assured by Congress that the project will actually be built. The level of cultural resource investigation which corresponds to the present stage of planning is a "reconnaissance", which attempts only to define the general nature and number of resources that might be present in the project area.

The South Carolina Department of Highways and Public Transportation (SCHD) has conducted a recent archeological survey of portions of Daniel Island and adjacent areas in order to evaluate the proposed Mark Clark East Expressway corridor. The survey does not provide sufficient coverage of the five potential disposal areas on which to base detailed evaluations of the prehistoric and historic sites present or on which to make recommendations as to the eligibility of the sites to the National Register. The survey does, however, provide a general discussion of prehistoric and historic occupation in the vicinity, a summary of previous cultural resource investigations in the area, and a description of the environment, all of which are applicable to the five potential areas proposed for use during the deepening of Charleston Harbor. In addition, the SCHD survey included a field examination of 25-30% of the northern areas. The southernmost area is a former disposal area, built on what was formerly open water and which had received several layers of dredged material before being converted to prime cropland. This area has almost no potential for yielding significant cultural resources. The SCHD survey can, therefore, be used to satisfy the Corps' requirement for a "reconnaissance" which is appropriate for this level of study.

The SCHO survey demonstrated the presence of both prehistoric and historic sites; it indicated that further, more detailed studies are warranted in the vicinity of the proposed expressway (and the disposal areas); and it predicted that further studies would turn up additional sites. Several conclusions as to the location of sites were drawn from the survey:

(1) "The larger historic sites found during this survey are generally in close proximity to a deep channel and marsh." (The five sites chosen for disposal of dredged material during the deepening project are located almost entirely in the upland segments of Daniel Island. Open water and marshes were avoided, primarily in an effort to prevent adverse impacts on water quality and wetlands.)

(2) "Large prehistoric sites are not as common in the survey area, as they are in the barrier island formations such as Edisto Island, James Island, Hilton Head Island and Kiawah Island or in areas immediately adjacent to the Atlantic Intracoastal Waterway."

(3) "Where prehistoric sites are found is generally in areas adjacent to frequently (inundated) small marsh inlets in environmental zones approximating the barrier islands and larger tidal marsh areas typical of the Atlantic Intracoastal Waterway."

(4) "The bulk of prehistoric sites found date to the Middle Woodland period, with very few Early Woodland sites located."

(5) "Site preference appears to have changed little from the Middle Woodland through the Historic period. Frequently, prehistoric sites show evidence of having been badly disturbed by the later, and more intense, occupations of the Historic period."

(6) "The major usefulness of the ceramics recovered by this survey is in chronological analysis. The various other artifact classes were so infrequently recovered as to limit their usefulness in revealing 'clues to patterned cultural activities' (South 1974: 169)."

In most cases, the integrity of the sites located by the SCHD survey was such that the limited value of the sites lies in the recovery of data, rather than in the preservation of the sites. In the very few cases where a site should be preserved, avoidance of the site by using other available lands appears to be a simple matter. (A portion of Thomas Island has already been eliminated from Plot B for this reason.) Careful recovery of the scattered data from other sites would realize their potential to contribute to regional archeology and history. These sites are not otherwise protected in any way, and have already been disturbed to a great degree. Recovery of data from these scattered sites by the Federal Government should be considered a positive contribution.

In summary, the reconnaissance has provided additional information on the potential disposal sites, but does not indicate that there are any significant impacts that can not be avoided prior to the final selection of sites. Nor are there any significant impacts due to the deepening of the channel which has been dredged annually for many years. There is no need to supplement the project EIS at this time. If upland sites, rather than ocean sites, are chosen for disposal of dredged material in the later stages of planning, surveys will be conducted on the specific tracts to intensively investigate the cultural resources present and to evaluate the sites for eligibility to the National Register. If, contrary to the indications of the SCHD report, significant sites are discovered which can not be avoided, a supplement to the EIS will be prepared at that time, and further steps will be taken to assure compliance with the National Historic Preservation Act of 1966, the Archeological and Historic Preservation Act of 1974, and Executive Order 11593.

ATTACHMENT 5 •
OTHER LAWS, EXECUTIVE ORDERS AND DIRECTIVES

OTHER LAWS, EXECUTIVE ORDERS AND DIRECTIVES

The Coastal Zone Management Act of 1972. The South Carolina Coastal Management Program was approved by the United States Department of Commerce on 24 September 1979, after most of the Phase I study on Charleston Harbor deepening had been completed. In conducting the Phase I study, however, the Charleston District used draft versions of the Coastal Management program to assure that the District's recommendations were consistent to the maximum extent practicable with the goals and policies of the program. The determination of consistency below covers only those activities which are a part of the recommended deepening project. Maintenance of the existing channels has been treated separately, since the scope of the current study and the Congressional authority deals only with improvements to the existing 35-foot project.

The deepening project was reviewed in light of the Coastal Management program's policies on dredging, dredged material disposal and navigation channels (Geographic Areas of Particular Concern), and in consideration of the following national interests: maintenance of navigation, interstate commerce, National Economic Development, and Environmental Quality. The deepening project, which follows the alignment of the existing channels, provides for the highest priority uses identified in the Coastal Management program for navigation channels (GAPC). The deepening of Charleston Harbor, as proposed, contributes to the general goals and objectives of the Coastal Management program and is entirely consistent with 38 of the 40 specific policies that apply to the project.

It will not, however, be feasible to restrict dredging operations in Charleston Harbor, a nursery area for many estuarine and marine species, in a manner that will avoid all periods of migration, spawning and early development of all species. The project is estimated to take from 2 to 2-1/2 years to complete, and the limitations imposed by the availability

of dredges as well as the excessive costs of shutting down the operation during most of the year make it impossible to avoid these periods of biological activity. The harbor has been regularly dredged for about 90 years without seriously affecting the marine resources.

Material dredged during the initial deepening would be placed on new upland areas which would be diked to minimize the impacts on water quality and on the nearby wetland areas. (If ocean dumping is feasible at the time of construction, upland areas would not be used.) Maintenance material would be placed in existing diked areas. It is not possible, however, to position all of the spillways from Charleston Harbor disposal areas to completely avoid wetland areas. Water containing some suspended and dissolved substances flows toward open waters, and in most cases must pass through a wetland area of some type. In some cases, the disposal area is bordered on all sides by at least a fringe of wetlands.

This development project is not consistent in all respects with the South Carolina Coastal Management program, but it is consistent to the maximum extent practicable. Supplementary information is contained in the main body of this report, the Final Environmental Impact Statement, and other portions of the Supplemental Information Report (pages 53 - 126).

Congressional authorization for the project is expected sometime in 1981. If the project is authorized by 1981, contracts could be awarded by 1984, and construction could begin in 1984 or 1985. Congressional authorization means that the project will proceed as outlined in this report; however, certain modifications can be made before the Notice to Proceed is given to the contractor.

A detailed description of the project and its associated facilities is contained in the main body of this report. The effects on the coastal zone and support for the consistency determination are found in the Final EIS and throughout this Supplemental Information Report.

Endangered Species Act of 1973. Based on the various investigations of potential upland disposal areas in the harbor and at the ocean disposal site, the proposed project will not affect any threatened or endangered species. Neither the continued existence nor critical habitat of threatened or endangered species is jeopardized by the project. Formal Section 7 coordination is not required; however, informal coordination has been initiated with the endangered species unit of the Asheville Area Office to give them the opportunity to review the District's finding of no effect.

Fish and Wildlife Coordination Act. The U. S. Fish and Wildlife Service (FWS) has been consulted throughout the various stages of planning, and the South Carolina Wildlife and Marine Resources Department (SCWMRD) was used to conduct most of the field studies pertaining to fish and wildlife in the Charleston Harbor area. Most of the inventory, the impact assessments, and the formulation of plans took place prior to 1975 and was included in the 1976 Final Environmental Impact Statement. By letter of 11 November 1974, the FWS reviewed the estuarine values studies conducted for the Charleston District, assessed the impacts of the project on aquatic resources of the harbor, and made several suggestions as to how impacts on fish and wildlife might be avoided or minimized. The Charleston District was able to incorporate all of the FWS suggestions into the recommended plan.

During the Phase I stage of planning, the FWS reviewed benthic studies conducted by the SCWMRD and examined upland disposal sites on Daniel Island. One beneficial input from this coordination was the designation of two additional disposal sites (D & E) which have been recommended for use in place of the other potential sites (A, B & C), in part due to the lesser impacts on wildlife. The Fish and Wildlife Coordination Act Report is included in Appendix E.

Estuarine Values Study developed under the direction of an ad hoc committee chaired by the FWS and coordinated with all interested agencies, and has served as the basis for plans and environmental assessments developed to date.

The Charleston District has informed the FWS that based on available data it does not agree to the mitigation plan as proposed by FWS. It was further related to the FWS that there are available alternatives to mitigate the marsh in question without requiring further Congressional action. Examples of such actions are:

- (1) Creation of marsh in shallow waters adjacent to the southern end of Clouter Creek during dredging operations;
- (2) Minor adjustment to the diking activities to the existing disposal area located at northern end of Clouter Creek;
- (3) Release of existing unused disposal areas of comparable value to the FWS;
- (4) Creation of marsh in shallow waters along the eastern side of Shipyard River; and
- (5) Creation of marsh in the Navy Blast Zone located adjacent to the marsh area in question.

The District is continuing to work with the FWS to eliminate any remaining differences and to develop alternative measures implementable within the project scope.

Executive Order 11988.

Section 2. E. O. 11988 was incorporated into the Water Resource Council's principles and Standards approach to planning for this project.

2(a)(1). Because of the very flat terrain surrounding Charleston Harbor, most of the land adjacent to the project area, including the five potential disposal sites on Daniel Island, is within the 100-year flood plain.

2(a)(2). Because of the urban nature of the Charleston area,

most of the land above the 100-year flood plain (and a considerable amount of land in the flood plain) is in residential, commercial, industrial, or military use, and is not available for disposal of dredged material. Daniel Island is the only large expanse of nearby uplands (i.e., not wetlands) which does not contain houses or other structures incompatible with the disposal of dredged material. Nearby areas east of the Wando River are also in the 100-year flood plain, and their use as disposal areas would cause greater impacts than the use of Daniel Island sites D and E. Existing diked disposal areas do not have sufficient capacity for material to be removed from the channel during deepening and the increase in material due to annual maintenance dredging of the deeper channel. Ocean disposal of inner harbor material can not be implemented at this time because of the unavailability of the special equipment required, but will probably be used if the equipment becomes available by the time of construction.

2(a)(2)(i). Most of the potential disposal areas on Daniel Island are farmlands and wooded areas. A description of the impacts on these areas was given in a previous section of this report entitled "Biological Studies for Potential Daniel Island Disposal Areas". In summary, the five areas are so rarely flooded that they provide few or none of the functions normally associated with flood plains (e.g., water storage, groundwater recharge, aquatic habitat, wetland vegetation, seasonal spawning areas, etc.). Their main value lies in their utility for growing crops, for pasture and for wildlife habitat (i.e., uses normally associated with non-flood plain areas as well as flood prone areas). Use of the five potential areas on Daniel Island would not result in increased occupancy or development in the flood plain and would not modify any of the important functions associated with flood plains. Diking of areas further reduces the potential for adverse impacts in adjacent areas.

2(a)(2)(ii). Should the upland areas of Daniel Island actually be selected for use, the Section 404 public notice normally circulated for public review will also explain why the proposed disposal areas are located in the 100-year flood plain.

2(a)(3). These public notices are circulated via the A-95 clearinghouse process.

2(a)(4). Opportunity for early public review was given in the public meetings and letters soliciting input into the planning process.

2(b). The proposed plan for Charleston Harbor deepening is in accord with Executive Order 11988, although circulation of the public notice will not take place until specific tracts of land are acquired by the local sponsor for disposal areas.

Section 3. Not applicable.

Section 4. Not applicable.

Executive Order 11990. Wetland policies of E. O. 11990 have been incorporated into the Principles and Standards planning process and into the 404(b) evaluation.

Analysis of Impacts on Prime and Unique Farmlands in EIS. The Final EIS discussed the current use of potential disposal sites on Daniel Island as farmland, assessed the impacts of disposal, and described the successive steps of dewatering and plant growth on upland areas that would eventually allow them to be used again for croplands. Land created on Daniel Island (See Site E, Figures 2-4) by previous disposal of dredged material is now being used to grow crops and the yields equal those of the prime natural farmlands in the vicinity. This assessment was incorporated into the multiobjective planning process.

Recommendations

It is recommended that the existing projects for deep draft navigation at Charleston, South Carolina, authorized by the Rivers and Harbors Act of August 1852 and July 1930 and as amended by Senate Document 136, 83rd Congress, 2nd Session, September 1954 and Rivers and Harbors Act of March 1945, respectively, be modified to provide for the construction and maintenance of a 40-foot and 38-foot Federal navigation project in Charleston Harbor (Cooper River) and Shipyard River, respectively, in accordance with the selected plan described in this report, with such modifications as in the discretion of the Chief of Engineers may be advisable; an added first cost to the United States presently estimated at \$47,519,000 exclusive of \$22,000 for aids to navigation, and annual operation, maintenance and replacement cost presently estimated at \$3,349,000 in addition to that now required, subject to the condition that no dredging shall be done by the United States within 125 feet of any established pierhead line, wharf, or other structure, and provided that prior to commencement of construction, non-Federal interests will agree to:

a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the selected or interim plans of improvement and for aids to navigation upon the request of the Chief of Engineers to be required in the general public interests for initial and subsequent disposal of dredged material, as well as the necessary retaining dikes, bulkheads, and embankments or the costs of such works, all at a presently estimated total non-Federal first cost of \$9,637,000. At the time of construction consideration will be given to implementing ocean disposal. If ocean disposal proves to be practical from the points of view of environmental protection, cost, and availability of equipment, local costs for the initial construction work would be significantly reduced.

b. Hold and save the United States free from damages that may result from the construction and maintenance of the project, except damages due to the fault or negligence of the United States or its contractors.

c. Provide and maintain without cost to the United States adequate public terminal and transfer facilities open to all on equal terms;

d. Provide and maintain without cost to the United States depths in berthing areas and local access channels serving the terminals commensurate with the depths provided in the related project areas;

e. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities, storm drains, utilities and other structures and improvements made necessary by the construction; and

f. Prohibit the erection of structures within 125 feet of the bottom edge of the recommended Federal project channels or turning basins.

A letter from the South Carolina State Ports Authority dated 31 March 1980 which outlines the State's intent to assure the above items of local cooperation is provided on Page E-65 of Appendix E. The South Carolina State Ports Authority is empowered by state statutes 54-1 through 54-22 of the 1962 Code of Laws and state law dated 15 June 1973 (R572, H1728) to legally enter into an agreement to furnish items of non-Federal participation.

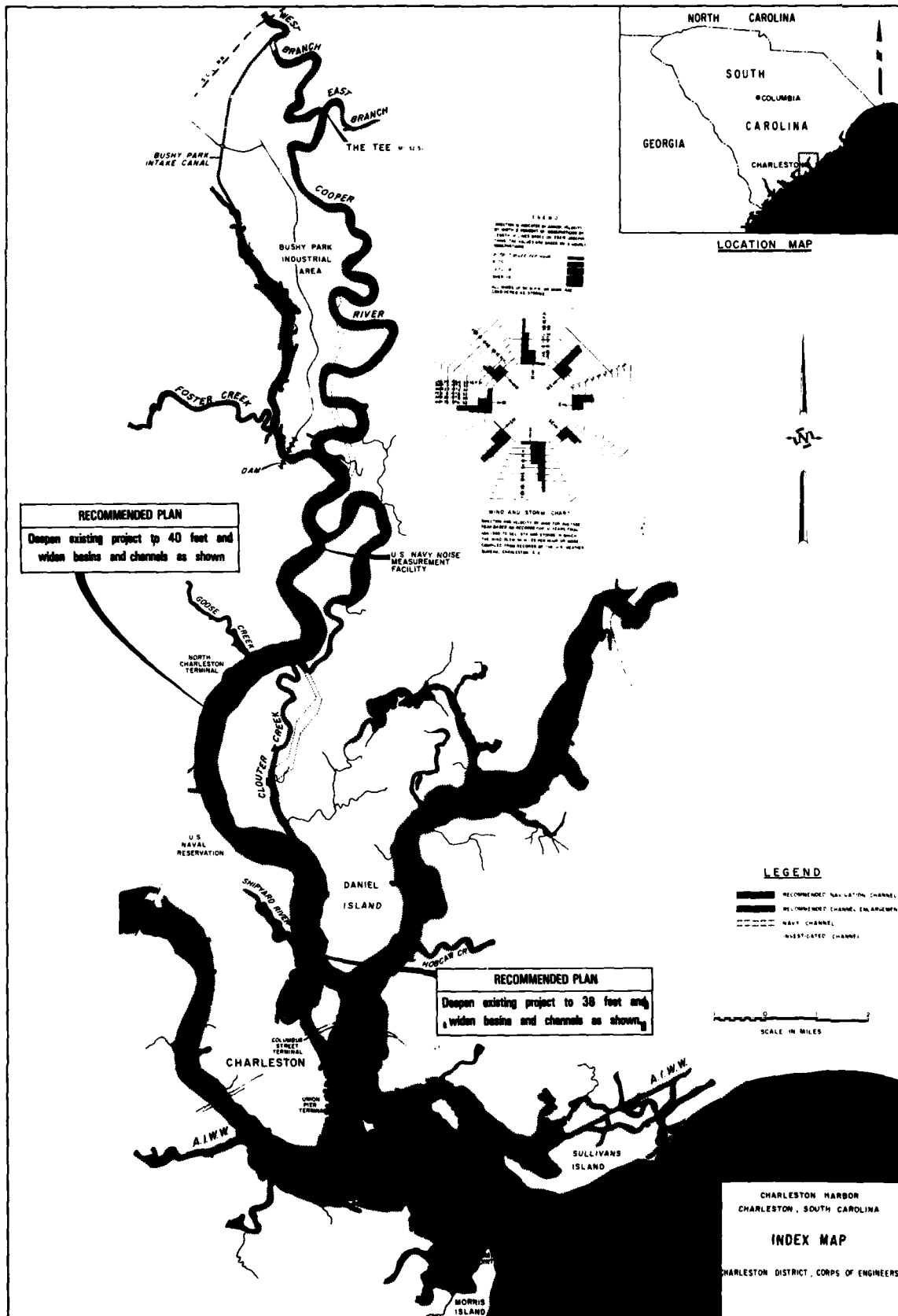
In addition to the above, the State of South Carolina will be required to make a cash contribution equal to 5% of the first costs of construction of the project, presently estimated at \$2,859,000.

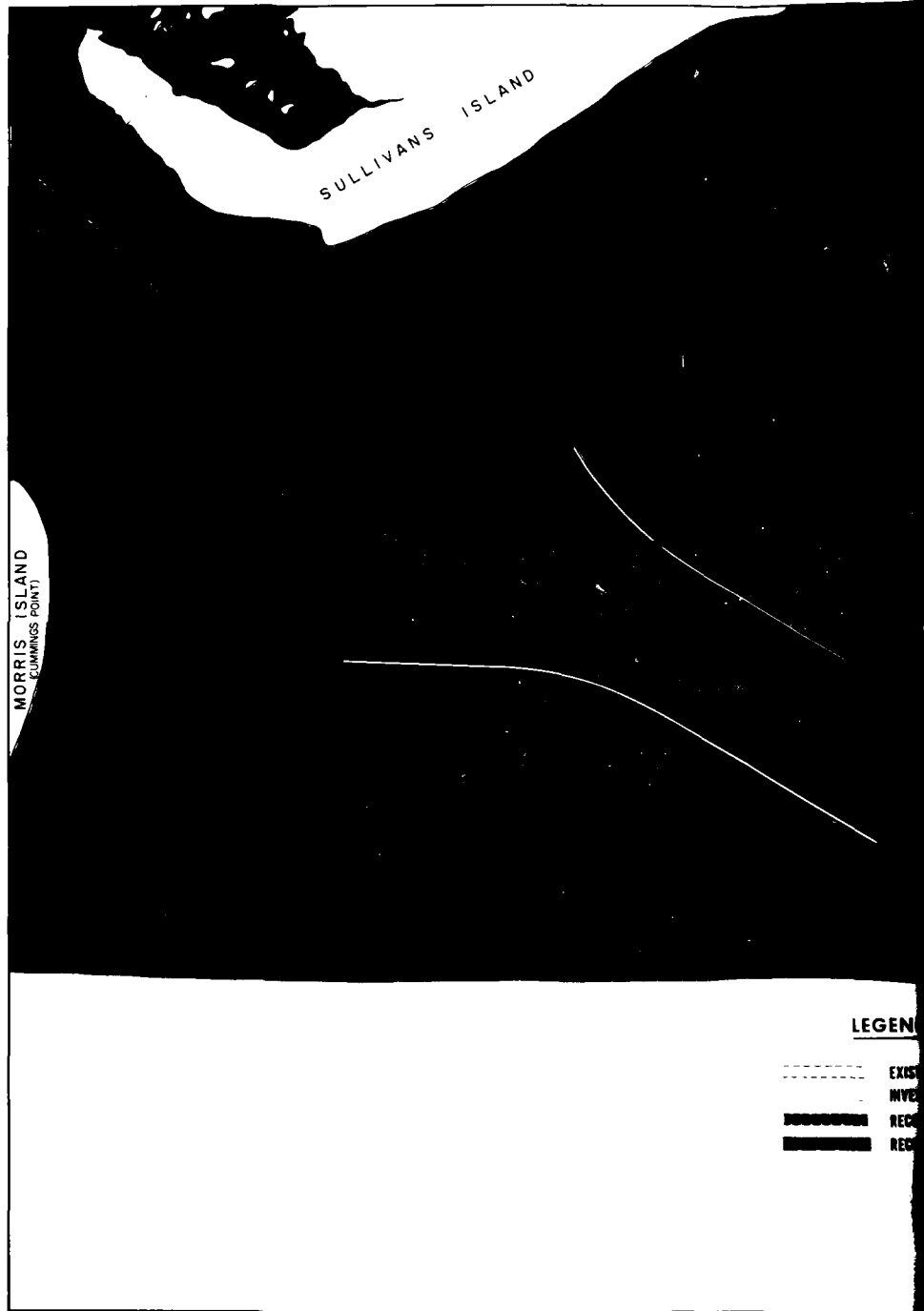
A letter from Governor Riley dated 19 February 1980, in response to this item of local cooperation, is shown on page E-62 of Appendix E. Governor Riley expressed firm support for the project as essential to the

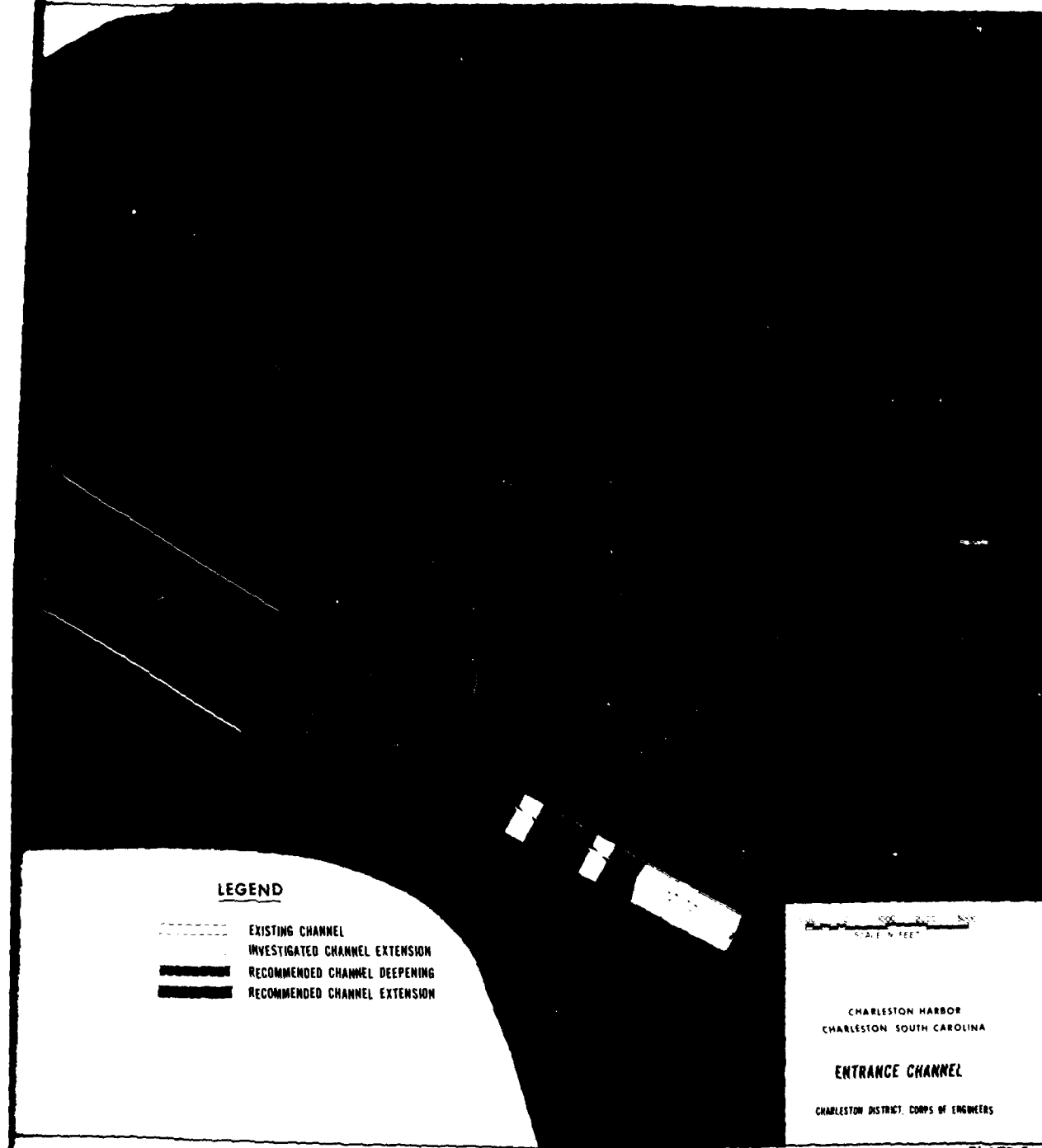
State's economy. However, he declined to declare a definite position on the President's 5% front end cost sharing because of present uncertainties regarding Congressional action on the water policy proposals.

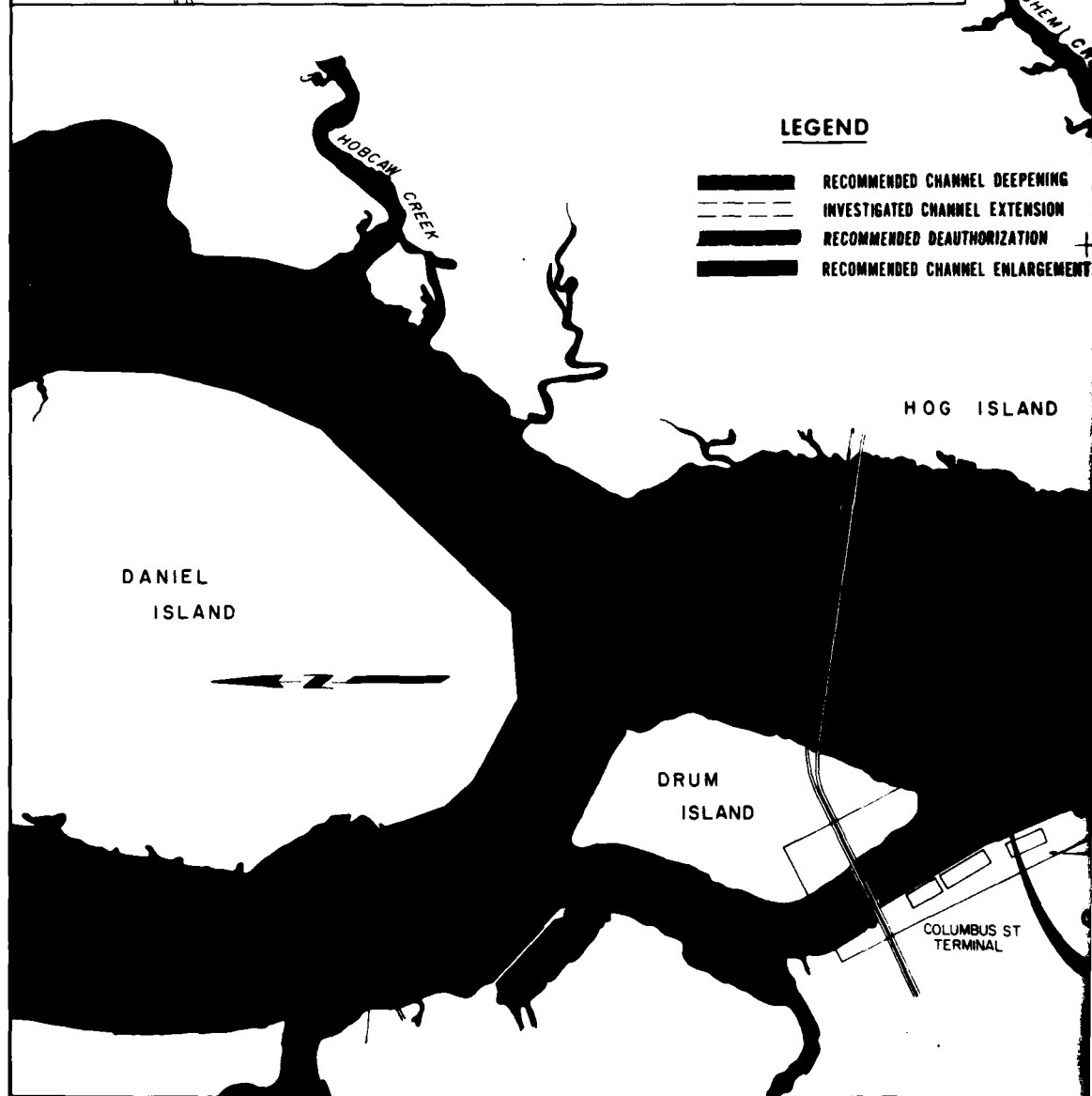
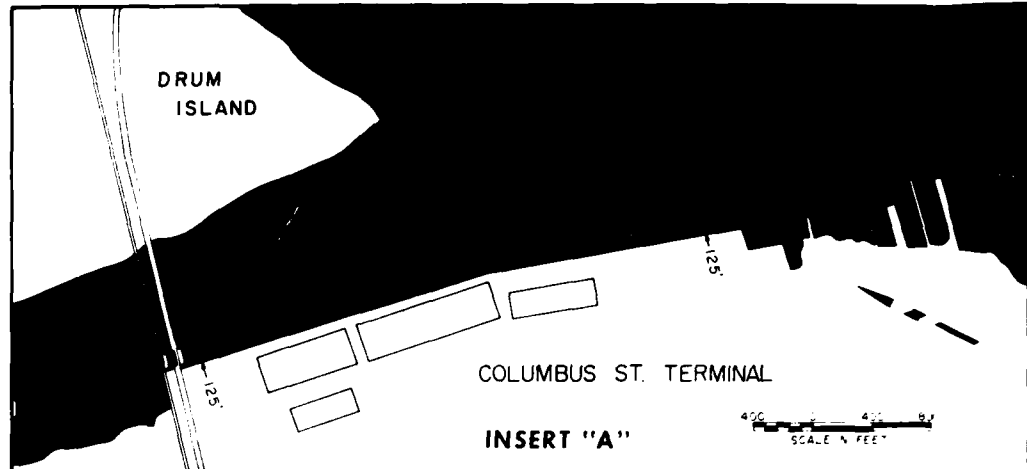
William W. Brown

WILLIAM W. BROWN
Colonel, Corps of Engineers
District Engineer

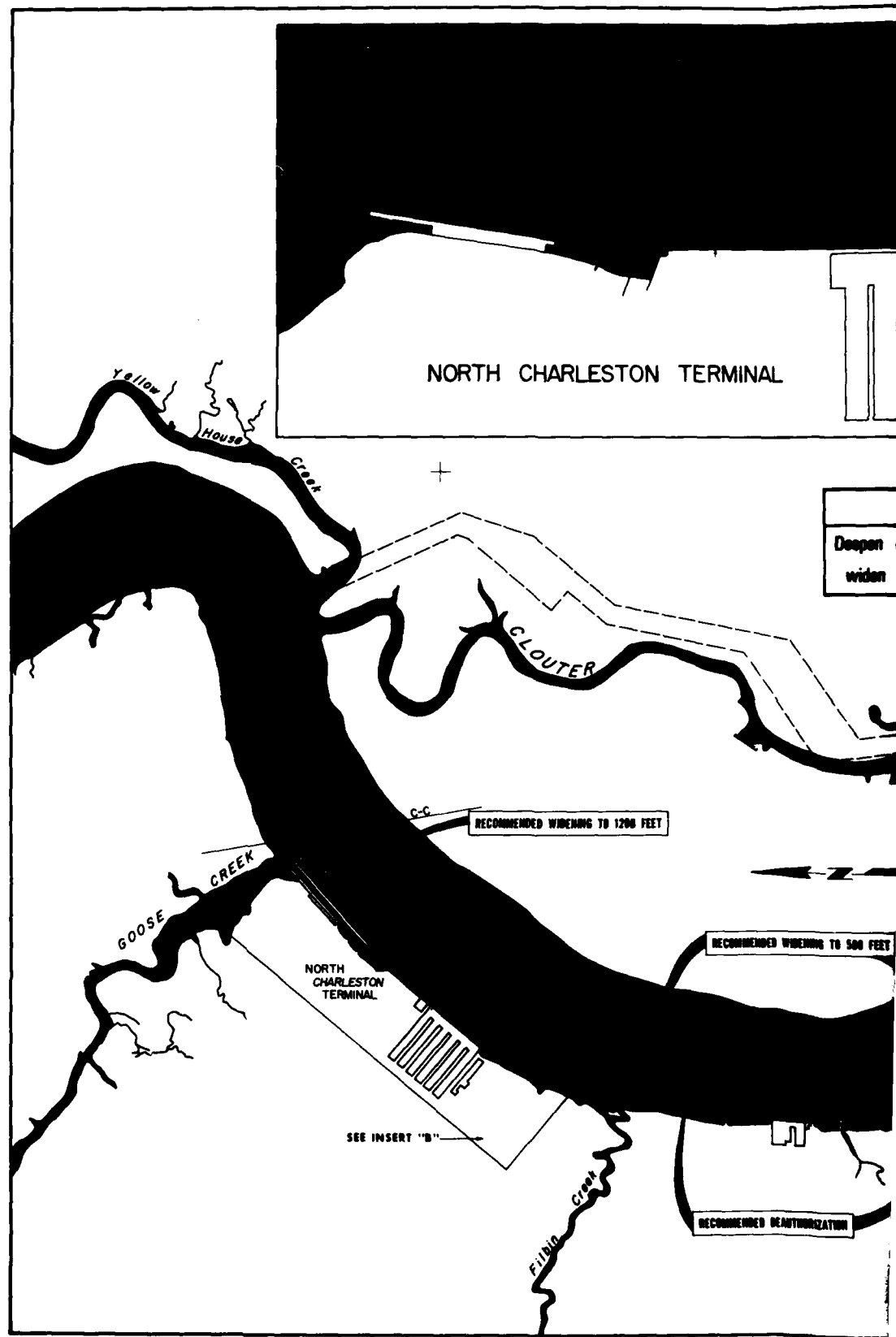




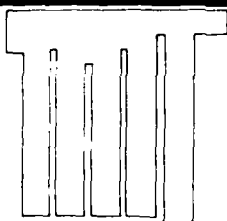








TERMINAL



INSERT "B"

400 0 400 800
SCALE IN FEET

RECOMMENDED PLAN

Deepen existing project to 40 feet and
widen basins and channels as shown.

CREEK

SHIPYARD RIVER

U. S. NAVAL RESERVATION

RECOMMENDED WIDENING TO 500 FEET

RECOMMENDED DEAUTHORIZATION

LEGEND

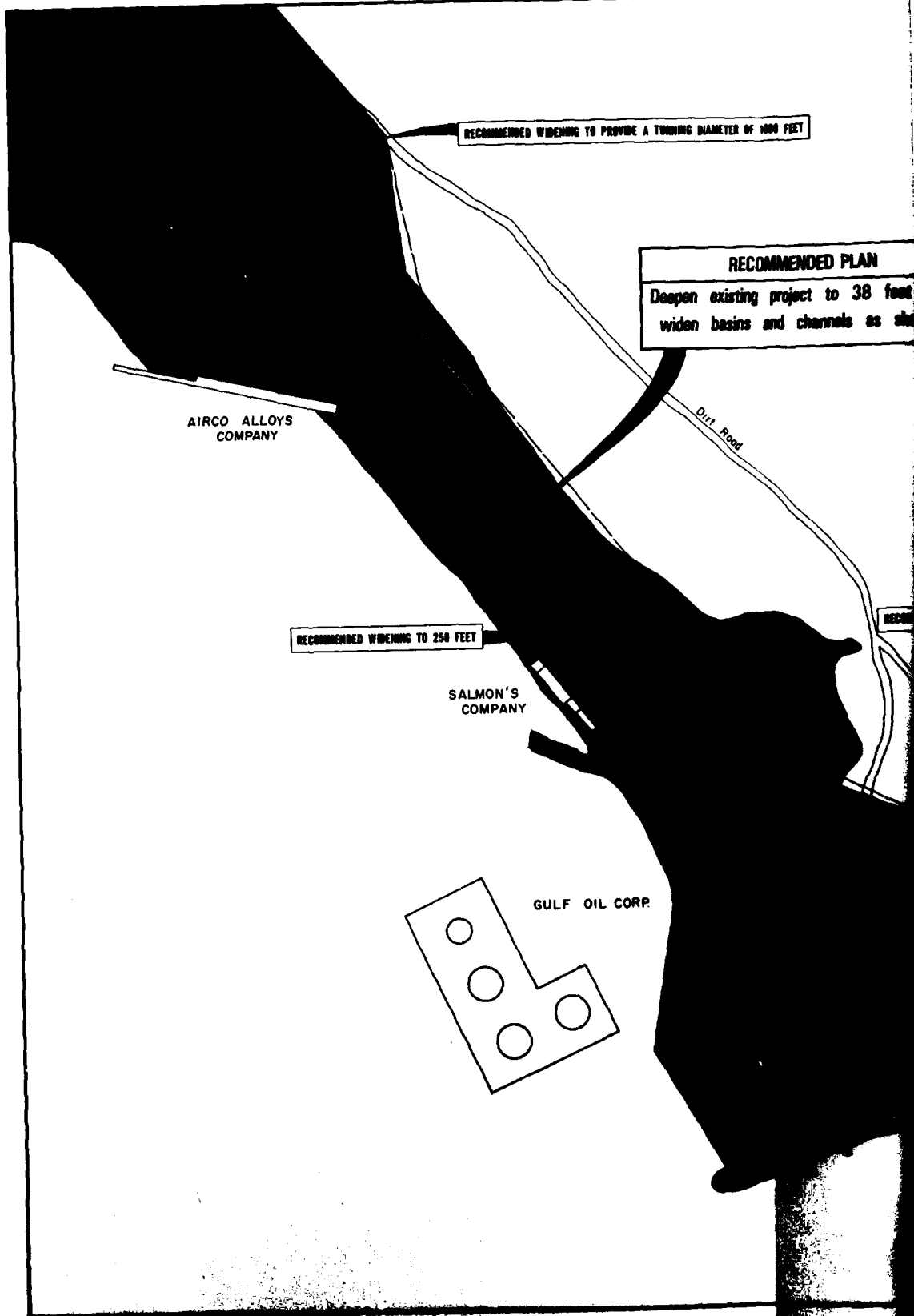
- RECOMMENDED CHANNEL DEEPENING
- INVESTIGATED CHANNEL EXTENSION
- RECOMMENDED DEAUTHORIZATION
- NAVY CHANNEL
- RECOMMENDED CHANNEL ENLARGEMENT

1000 0 1000 2000 3000
SCALE IN FEET

CHARLESTON HARBOR
CHARLESTON, SOUTH CAROLINA

SHIPYARD RIVER TO GOOSE CREEK

CHARLESTON DISTRICT, CORPS OF ENGINEERS



2 A TURNING DIAMETER OF 1000 FEET

RECOMMENDED PLAN

Deepen existing project to 38 feet and
widen basins and channels as shown.

LEGEND

- EXISTING CHANNEL
- - - INVESTIGATED CHANNEL EXTENSION
- ███ RECOMMENDED DEAUTHORIZATION
- ███ RECOMMENDED CHANNEL DEEPENING
- ███ RECOMMENDED CHANNEL ENLARGEMENT

Dirt Road

RECOMMENDED WIDENING TO PROVIDE A TURNING DIAMETER OF 1000 FEET

NAVY PIER "Y"

ETIWAN
FERTILIZER
COMPANY

CHARLESTON HARBOR
CHARLESTON, SOUTH CAROLINA

SHIPYARD RIVER

CHARLESTON DISTRICT, CORPS OF ENGINEERS

PLATE 5

7-8